

MULTIPOINT FUEL INJECTION (MPI)

GENERAL INFORMATION

The Multipoint Fuel Injection System consists of sensors which detect the engine conditions, the Engine-ECU which controls the system based on signals from these sensors, and actuators which operate under the control of the Engine-ECU. The Engine-ECU carries out activities such as fuel injection control, idle speed control and ignition timing control. In addition, the Engine-ECU is equipped with several diagnosis modes which simplify troubleshooting when a problem develops.

FUEL INJECTION CONTROL

The injector drive times and injector timing are controlled so that the optimum air/fuel mixture is supplied to the engine to correspond to the continually-changing engine operation conditions. A single injector is mounted at the intake port of each cylinder. Fuel is sent under pressure from the fuel tank by the fuel pump, with the pressure being regulated by the fuel pressure regulator. The fuel thus regulated is distributed to each of the injectors. Fuel injection is normally carried out once for each cylinder for every two rotations of the crankshaft. The firing order is 1-2-3-4-5-6. The Engine-ECU provides a richer air/fuel mixture by carrying out "open-loop" control when the engine is cold or operating under high load conditions in order to maintain engine performance. In addition, when the engine is warm or operating under normal conditions, the Engine-ECU controls the air/fuel mixture by using the oxygen sensor signal to carry out "closed-loop" control in order to obtain the theoretical air/fuel mixture ratio that provides the maximum cleaning performance from the three way catalyst <if equipped>.

IDLE AIR CONTROL

The idle speed is kept at the optimum speed by controlling the amount of air that bypasses the throttle valve in accordance with changes in idling conditions and engine load during idling. The Engine-ECU drives the idle air control (ISC) motor to keep the engine running at the pre-set idle target speed in accordance with the engine coolant temperature and air conditioner load. In addition, when the air conditioning switch is turned off and on while the engine is idling, the ISC motor operates to adjust the throttle valve bypass air amount in accordance with the engine load conditions in order to avoid fluctuations in the engine speed.

IGNITION TIMING CONTROL

The ignition power transistor located in the ignition primary circuit turns ON and OFF to control the primary current flow to the ignition coil. This controls the ignition timing in order to provide the optimum ignition timing with respect to the engine operating conditions. The ignition timing is determined by the Engine-ECU from the engine speed, intake air volume, engine coolant temperature and atmospheric pressure.

SELF DIAGNOSIS FUNCTION

- When an abnormality is detected in one of the sensors or actuators related to emission control, the engine warning lamp (check engine lamp) illuminates as a warning to the driver.
- When an abnormality is detected in one of the sensors or actuators, a diagnosis code corresponding to the abnormality is output.
- The RAM data inside the Engine-ECU that is related to the sensors and actuators can be read by means of the MUT-II. In addition, the actuators can be controlled under certain circumstances.

OTHER CONTROL FUNCTIONS

1. Fuel Pump Control
Turns the fuel pump relay ON so that current is supplied to the fuel pump while the engine is cranking or running.
2. A/C Compressor Clutch Relay Control
Turns the compressor clutch of the A/C ON and OFF.
3. Fan Relay Control
The radiator fan and condenser fan speeds are controlled in response to the engine coolant temperature and vehicle speed.
4. Traction Control
Engine output torque is reduced based on signals from the TCL-ECU in response to the conditions under which slipping of the driven wheels and turning of the vehicle occur.
Furthermore, reduction of output torque is performed by closing the throttle valve and retarding the ignition timing.
5. Evaporative Emission Purge Control
(Refer [GROUP 17.](#))
6. EGR Control
(Refer [GROUP 17.](#))

GENERAL SPECIFICATIONS

Items		Specifications
Throttle body	Throttle bore mm	65 mm
	Throttle position sensor	Variable resistor type
	Accelerator position sensor <Vehicles with TCL>	Variable resistor type
	Idle speed control servo	Stepper motor type [Stepper motor type by-pass air control system]
	Closed throttle position switch <Vehicles without TCL>	Rotary contact type, within throttle position sensor
	Closed throttle position switch <Vehicles with TCL>	Rotary contact type, within accelerator pedal position sensor
Sensors	Air flow sensor	Karman vortex type
	Barometric pressure sensor	Semiconductor type
	Intake air temperature sensor	Thermistor type
	Engine coolant temperature sensor	Thermistor type
	Oxygen sensor	Zirconia type
	Vehicle speed sensor	Hall element type
	Inhibitor switch	Contact switch type
	Camshaft position sensor	Hall element type
	Crank angle sensor	Hall element type
	Power steering pressure switch	Contact switch type
Actuators	Multipoint fuel injection control relay	Contact switch type
	Fuel pump relay	Contact switch type
	Injector type and number	Electromagnetic type, 6
	Injector identification mark	CDH275
	EGR solenoid	Duty cycle type solenoid
	Evaporative emission purge solenoid	Duty cycle type solenoid
	Evaporative emission ventilation solenoid	Duty cycle type solenoid
	Vacuum control solenoid valve <Vehicles with TCL>	Duty cycle type solenoid
	Ventilation control solenoid valve <Vehicles with TCL>	Duty cycle type solenoid
Fuel pressure regulator	Regulator pressure kPa	329

MULTIPOINT FUEL INJECTION (MPI) SYSTEM DIAGRAM

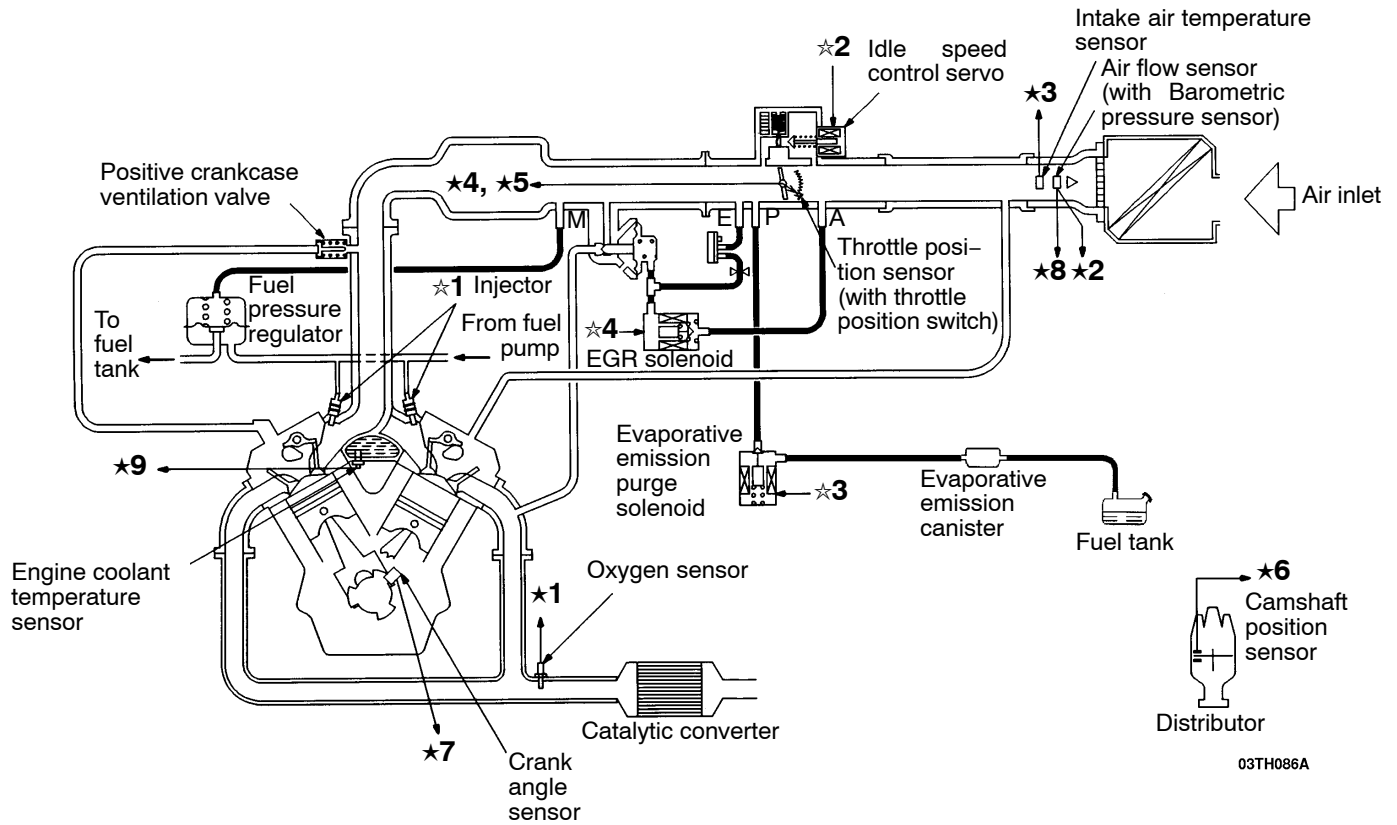
- ★1 Oxygen sensor
- ★2 Air flow sensor
- ★3 Intake air temperature sensor
- ★4 Throttle position sensor
- ★5 Closed throttle position switch
- ★6 Camshaft position sensor
- ★7 Crank angle sensor
- ★8 Barometric pressure sensor
- ★9 Engine coolant temperature sensor

- Power supply
- Knock sensor
- Vehicle speed sensor
- A/C switch
- Inhibitor switch
- Power steering pressure switch
- Ignition switch-ST
- Ignition switch-IG

⇒ Engine-ECU ⇒

- ★1 Injector
- ★2 Idle speed control servo
- ★3 Evaporative emission purge solenoid
- ★4 EGR solenoid

- Fuel pump relay
- Control relay
- A/C compressor clutch relay
- Engine warning lamp
- Diagnosis output
- Ignition coil, Ignition power transistor


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MULTIPOINT FUEL INJECTION (MPI) SYSTEM DIAGRAM <WITH TCL>

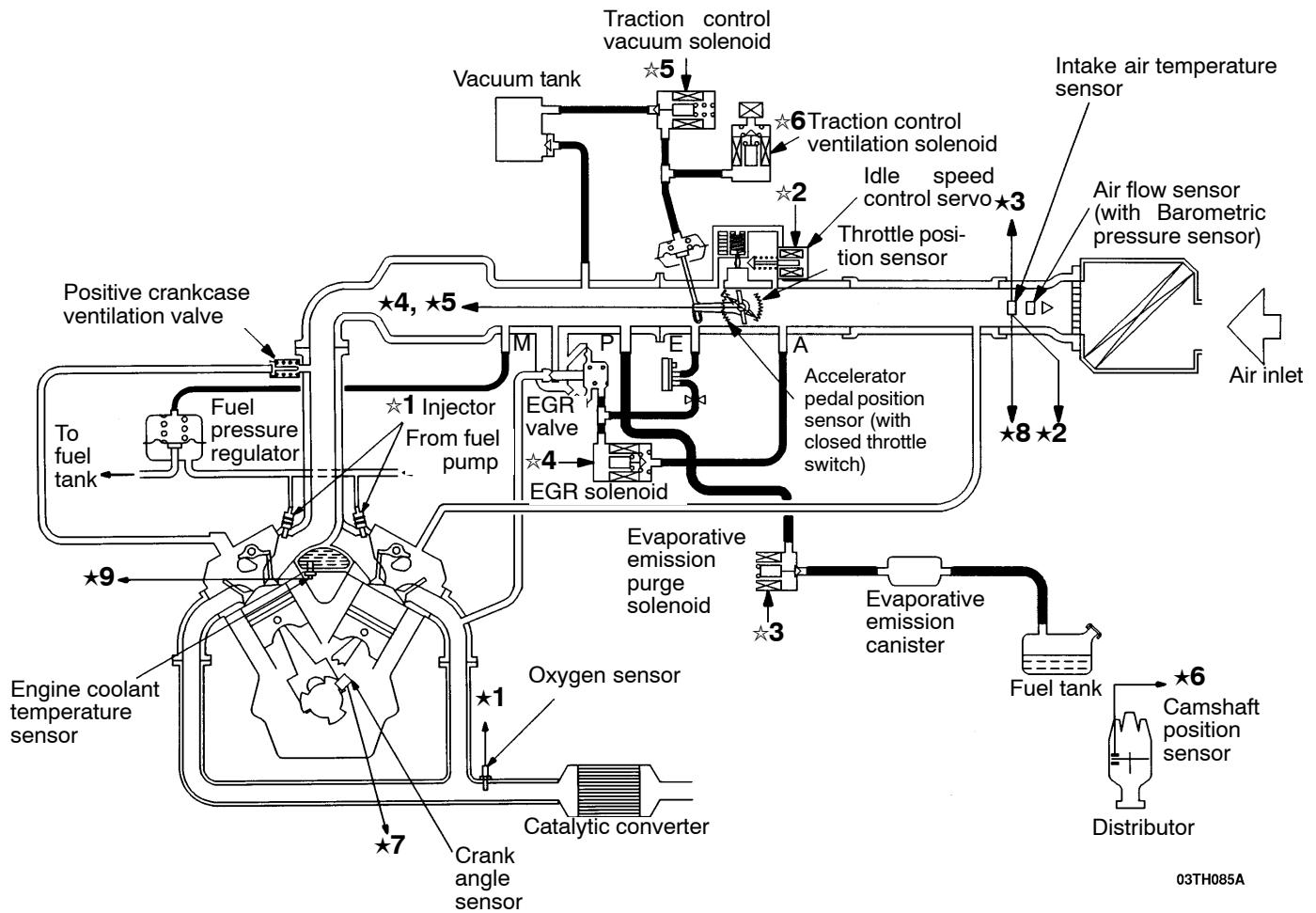
- ★1 Oxygen sensor
- ★2 Air flow sensor
- ★3 Intake air temperature sensor
- ★4 Throttle position sensor
- ★5 Closed throttle position switch
- ★6 Camshaft position sensor
- ★7 Crank angle sensor
- ★8 Barometric pressure sensor
- ★9 Engine coolant temperature sensor

- Power supply
- Knock sensor
- Vehicle speed sensor
- A/C switch
- Inhibitor switch
- Power steering pressure switch
- Ignition switch-ST
- Ignition switch-IG

⇒ Engine-ECU ⇒

- ★1 Injector
- ★2 Idle speed control servo
- ★3 Evaporative emission purge solenoid
- ★4 EGR solenoid
- ★5 Traction control vacuum solenoid
- ★6 Traction control ventilation solenoid

- Fuel pump relay
- Control relay
- A/C compressor clutch relay
- Engine warning lamp
- Diagnosis output
- Ignition coil, Ignition power transistor



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SERVICE SPECIFICATIONS

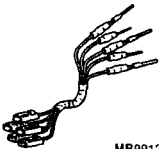



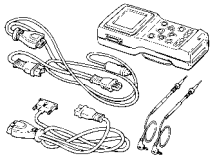
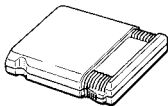
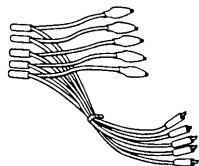
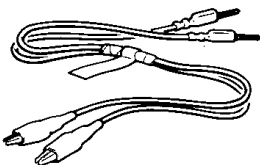
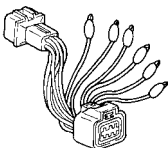
Items		Standard value
Basic ignition timing		5° BTDC ± 3° at curb idle
Curb idle speed r/min		700 ± 100
Idle speed when A/C is ON r/min		900 in Neutral
Basic idle speed r/min		700 ± 50
Throttle position sensor adjusting voltage mV	Vehicles with-out TCL	400–1000
	Vehicles with TCL	580–690
Throttle position sensor resistance kΩ		3.5–6.5
Intake air temperature sensor resistance kΩ	20°C	2.3–3.0
	80°C	0.30–0.42
Engine coolant temperature sensor resistance kΩ	20°C	2.1–2.7
	80°C	0.26–0.36
Oxygen sensor output voltage V		0.6–1.0
Fuel pressure kPa	Vacuum hose disconnected	324–343 at curb idle
	Vacuum hose connected	Approx. 265 at curb idle
Injector coil resistance Ω		13–16 [at 20°C]
Ventilation control solenoid valve coil resistance Ω		36–44 [at 20°C]
Vacuum control solenoid valve coil resistance Ω		36–44 [at 20°C]

SEALANT

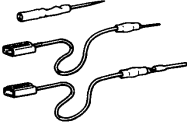

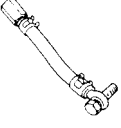

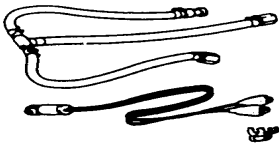

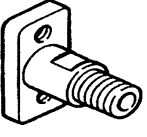
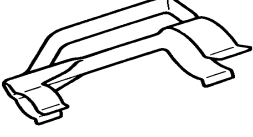
Item	Specified sealant
Engine coolant temperature sensor threaded portion	Loctite 577 or equivalent

SPECIAL TOOLS

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Tool	Tool number and name	Supersession	Application
<p>A</p>  <p>MB991219</p> <p>B</p>  <p>MB991220</p> <p>C</p>  <p>MB991221</p> <p>D</p>  <p>MB991222 MB991223</p>	<p>MB991223 A: MB991219 B: MB991220 C: MB991221 D: MB991222</p> <p>Harness Set A: Test harness B: Led harness C: LED harness adaptor D: Probe</p>	–	<ul style="list-style-type: none"> Fuel gauge simple inspection <p>Measurement of terminal voltage</p> <p>A: Connector pin contact pressure inspection B, C: Power circuit inspection D: Commercial tester connection</p>
	MB991502 MUT-II	–	<ul style="list-style-type: none"> Reading diagnosis codes MPI system inspection
	ROM pack	–	
	MB991348 Test harness set	EMB991348	<ul style="list-style-type: none"> Adjustment of throttle position switch, throttle position sensor Inspection using an analyser
	MB991529 Diagnosis code check harness	–	Checking the diagnosis codes.
	MB998463 Test harness (6 pin, square)	E8M19	<ul style="list-style-type: none"> Inspection of ISC servo motor Inspection using an analyser

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Tool	Tool number and name	Supersession	Application
	MD991223 Test harness	–	<ul style="list-style-type: none"> • Inspection of oxygen sensor • Inspection using an analyser
	MD998478 Test harness (3 pin, triangle)	E8M21	Inspection using an analyser
	MD998709 Adaptor hose	E14M35	Measurement of fuel pressure
	MD998742 Hose adaptor	MD998742-01	
	MD998706 Injector test set	–	Checking the spray condition of injectors
	MD991607 Injector test harness	–	
	MD998741 Injector test adaptor	–	
	MB991609 Clip	–	

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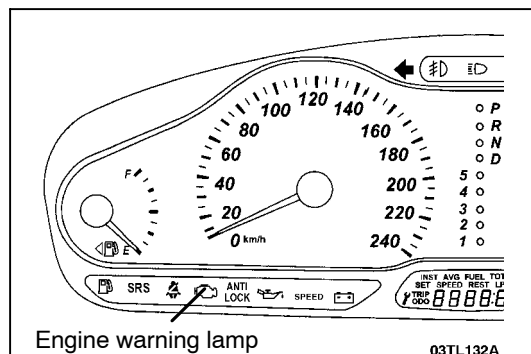
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TROUBLESHOOTING

DIAGNOSIS TROUBLESHOOTING FLOW

Refer to [GROUP 00 - How to Use Troubleshooting / Inspection Service Points](#).



DIAGNOSIS FUNCTION

ENGINE WARNING LAMP (CHECK ENGINE LAMP)

If an abnormality occurs in any of the following items relating to the Multipoint Fuel Injection (MPI) system, the engine warning lamp will illuminate.

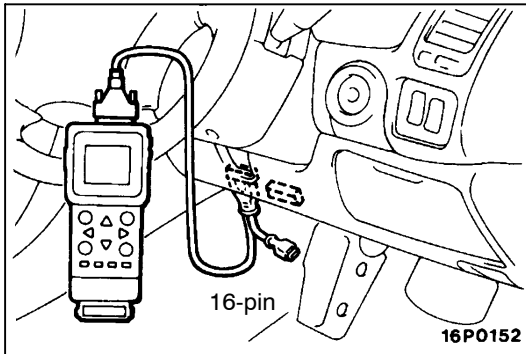
If the lamp remains illuminated or if the lamp illuminates when the engine is running, check the diagnosis code output.

Engine warning lamp inspection items

Engine-ECU
Air flow sensor
Intake air temperature sensor
Throttle position sensor
Engine coolant temperature sensor
Crank angle sensor
Top dead centre sensor
Injector
Barometric pressure sensor
Ignition coil, power transistor
Immobiliser system

Caution

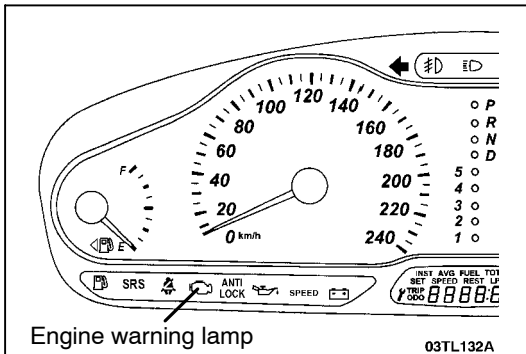
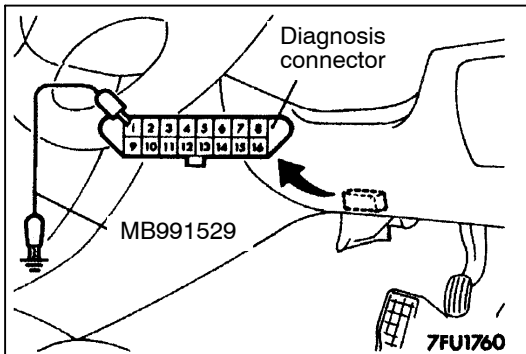
Engine warning lamp will come on even when ignition timing check is performed. Therefore, it is not abnormal that the lamp comes on at the time of ignition timing check.



READING DIAGNOSIS TROUBLE CODES

WHEN USING MUT-II

1. Connect the MUT-II to the diagnosis connector (16 pin), switch the ignition ON and take a reading of the diagnosis codes.
2. Repair the malfunction location while referring to the [Inspection chart for diagnosis trouble codes](#).
3. Turn the ignition switch to OFF and then back ON again.
4. Erase the diagnosis codes using the MUT-II.
5. Check to be sure that the diagnosis code is normal.
5. Erase the diagnosis codes.



WHEN USING THE ENGINE WARNING LAMP

(CHECK ENGINE LAMP)

1. Use the special tool (diagnosis code check harness) to earth terminal 1 of the diagnosis connector (16 pin).
2. Take a reading of the diagnosis code from the flashing of the engine warning lamp.
3. Repair the malfunction location while referring to the [Inspection chart for diagnosis trouble codes](#).
4. After disconnecting the battery cable from the battery (-) terminal for 10 seconds or more, re-connect the cable.
5. After the engine has warmed up, run it at idle for about 10 minutes.

DIAGNOSIS RESULT DISPLAY METHOD WHEN USING THE ENGINE WARNING LAMP

Example of flashing when a diagnosis code is output	Flashing when normal
<p>When diagnosis code No. 24 is output</p> <p>12V 0V</p> <p>1.5 sec. 0.5 sec. 0.5 sec.</p> <p>Pause time 3 secs. Tens signal Place division 2 secs. Units signal</p>	<p>When no diagnosis code is output</p> <p>12V 0V</p> <p>0.5 sec.</p>

DIAGNOSIS USING DIAGNOSIS 2 MODE

1. Switch the diagnosis mode of the engine control unit to DIAGNOSIS 2 mode using the MUT-II.
2. Carry out a road test.
3. Take a reading of the diagnosis code and repair the problem location.
4. Turn the ignition switch to OFF and then back to ON again.

NOTE

By turning the ignition switch to OFF, the ENGINE-ECU will switch the diagnosis mode from DIAGNOSIS 2 mode to DIAGNOSIS 1 mode.

5. Erase the diagnosis codes.

FAIL-SAFE FUNCTION REFERENCE TABLE

When the main sensor malfunctions are detected by the diagnosis function, the vehicle is controlled by means of the pre-set control logic to maintain safe conditions for driving.

Malfunctioning item	Control contents during malfunction
Air flow sensor	<ol style="list-style-type: none"> 1. Uses the throttle position sensor signal and engine speed signal (crank angle sensor signal) for basic injector drive time and basic ignition timing from the pre-set mapping. 2. Fixes the ISC servo in the appointed position so idle air control is not performed.
Intake air temperature sensor	Controls as if the intake air temperature is 25°C.
Throttle position sensor (TPS)	No increase in fuel injection amount during acceleration due to the unreliable throttle position sensor signal.
Engine coolant temperature sensor	Controls as if the engine coolant temperature is 80°C.
Top dead centre sensor	Injects fuel simultaneously into all cylinders. (After the ignition switch is turned to ON, No. 1 cylinder top dead centre is not detected at all.)
Barometric pressure sensor	Controls as if the barometric pressure is 101 kPa (sea level)
Communication line with transmission control module	No ignition timing retard (overall engine-transmission control) achieved when transmission speeds are changed.

TROUBLESHOOTING

INSPECTION CHART FOR DIAGNOSIS

Code No.	Diagnosis Item
12	Air flow sensor system
13	Intake air temperature sensor system
14	Throttle position sensor system
21	Engine coolant temperature sensor system
22	Crank angle sensor system
23	Top dead centre sensor system
24	Vehicle speed sensor system
25	Barometric pressure sensor system
41	Injector system
44	Ignition coil and power transistor unit system
54	Immobiliser system
61	Communication with A/T-ECU system <A/T>
72	Vacuum control solenoid valve system <vehicles with traction control>
73	Ventilation control solenoid valve system <vehicles with traction control>

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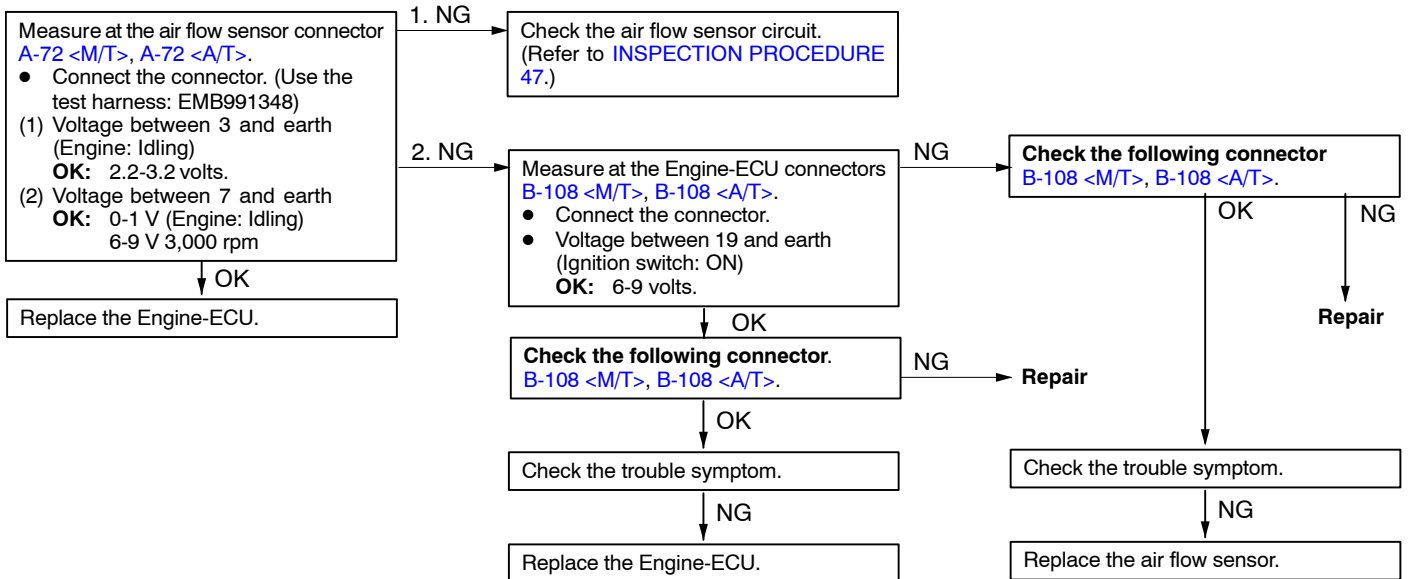
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Code No. 12 Air flow sensor system	Probable cause
Range of Check • Engine speed is 500 rpm or more Set conditions • Sensor output frequency is 3 Hz or less for 4 seconds.	• Malfunction of the air flow sensor • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the Engine-ECU



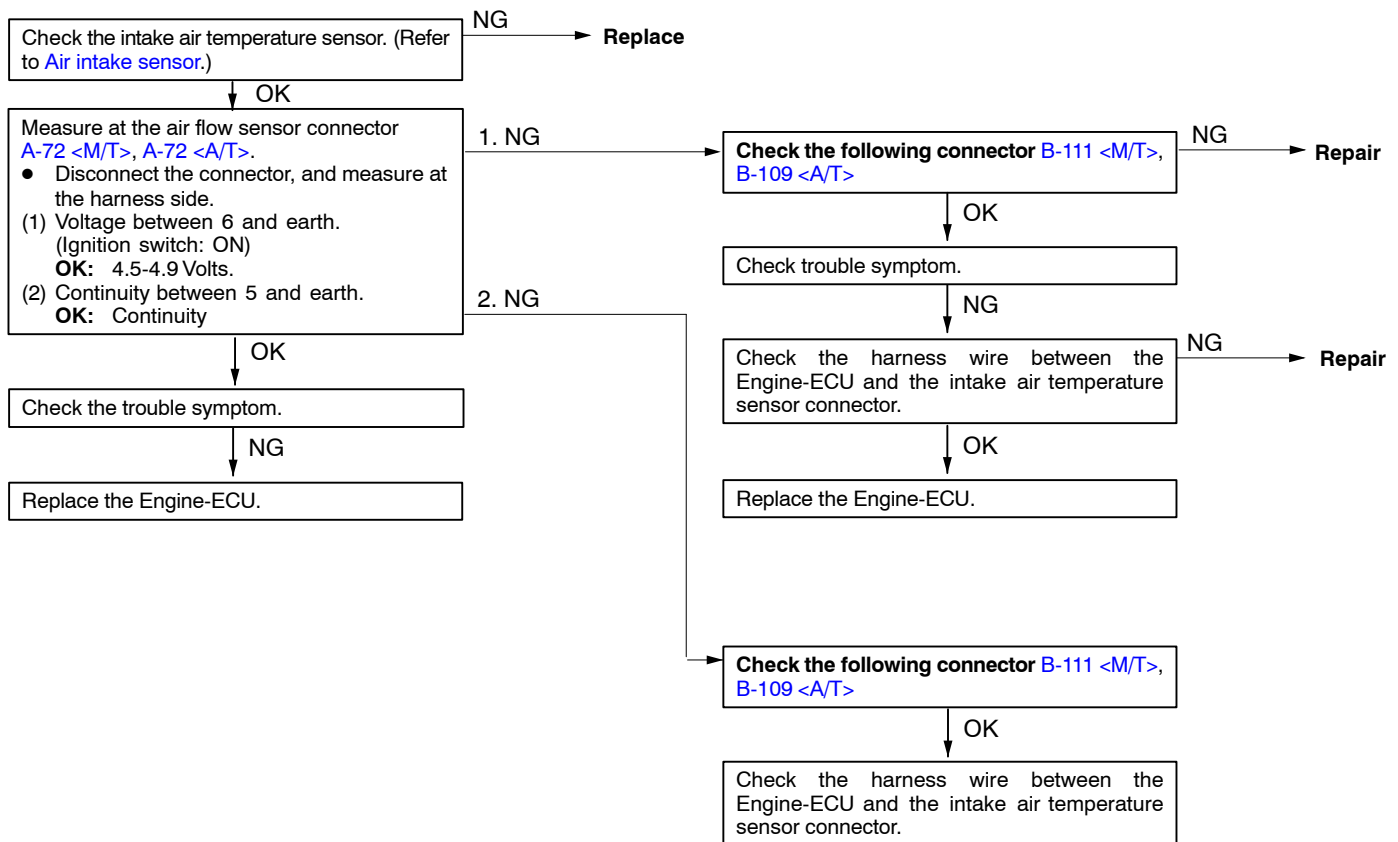
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Code No. 13 Intake air temperature sensor system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> Ignition switch: ON Excluding 60 seconds after the ignition is turned to ON or immediately after the engine starts. <p>Set conditions</p> <ul style="list-style-type: none"> Sensor output voltage is 4.6 V or more (corresponding to an intake air temperature of -45°C or less) for 4 seconds. <p>or</p> <ul style="list-style-type: none"> Sensor output voltage is 0.2 V or more (corresponding to an intake air temperature of -125°C or more) for 4 seconds. 	<ul style="list-style-type: none"> Malfunction of the intake air temperature sensor Improper connector contact, open circuit or short-circuited harness wire of the intake air temperature sensor circuit Malfunction of the Engine-ECU



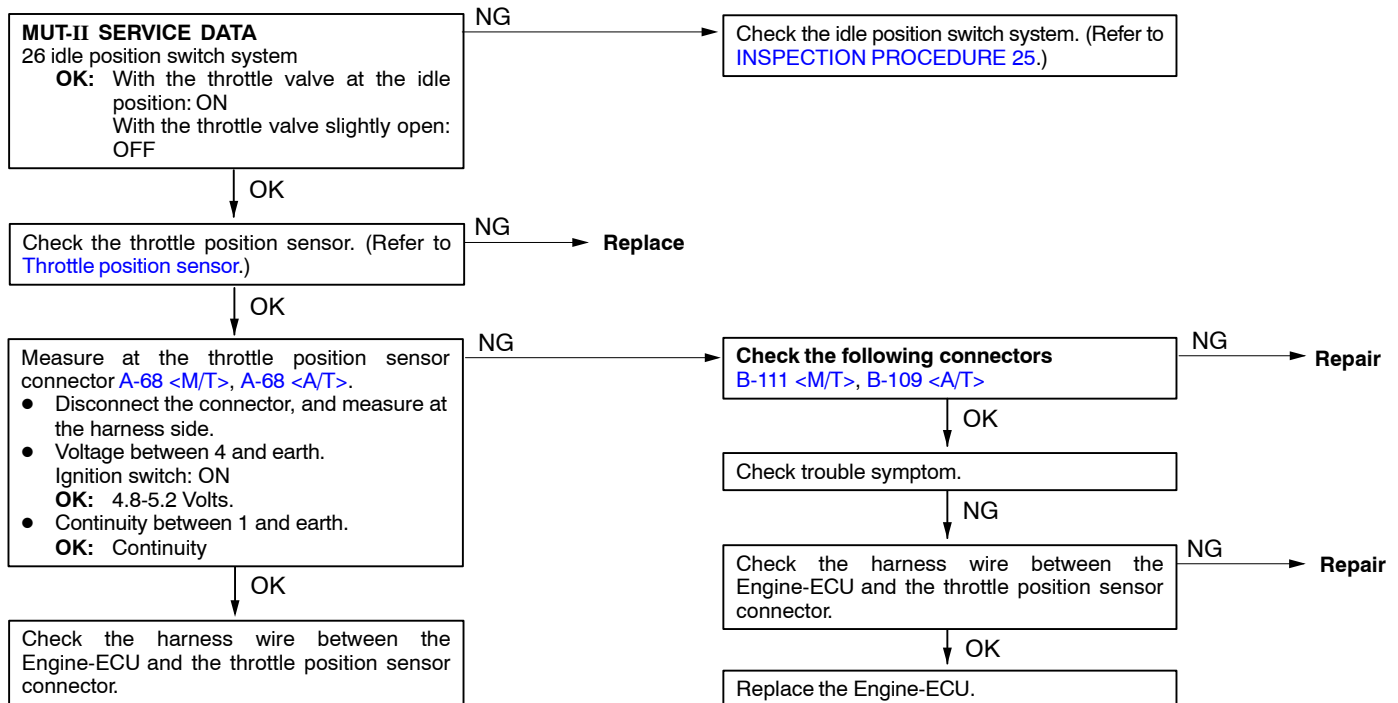
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Code No. 14 Throttle position sensor system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> Ignition switch: ON Excluding 60 seconds after the ignition is turned to ON or immediately after the engine starts. <p>Set conditions</p> <ul style="list-style-type: none"> When the idle position Switch is ON, the sensor output voltage is 2 Volts or more for 4 seconds <p>or</p> <ul style="list-style-type: none"> Sensor output voltage is 0.2 V or less for 4 seconds. 	<ul style="list-style-type: none"> Malfunction of the throttle sensor or maladjustment Improper connector contact, open circuit or short-circuited harness wire of the intake air temperature sensor circuit Malfunction of the Engine-ECU



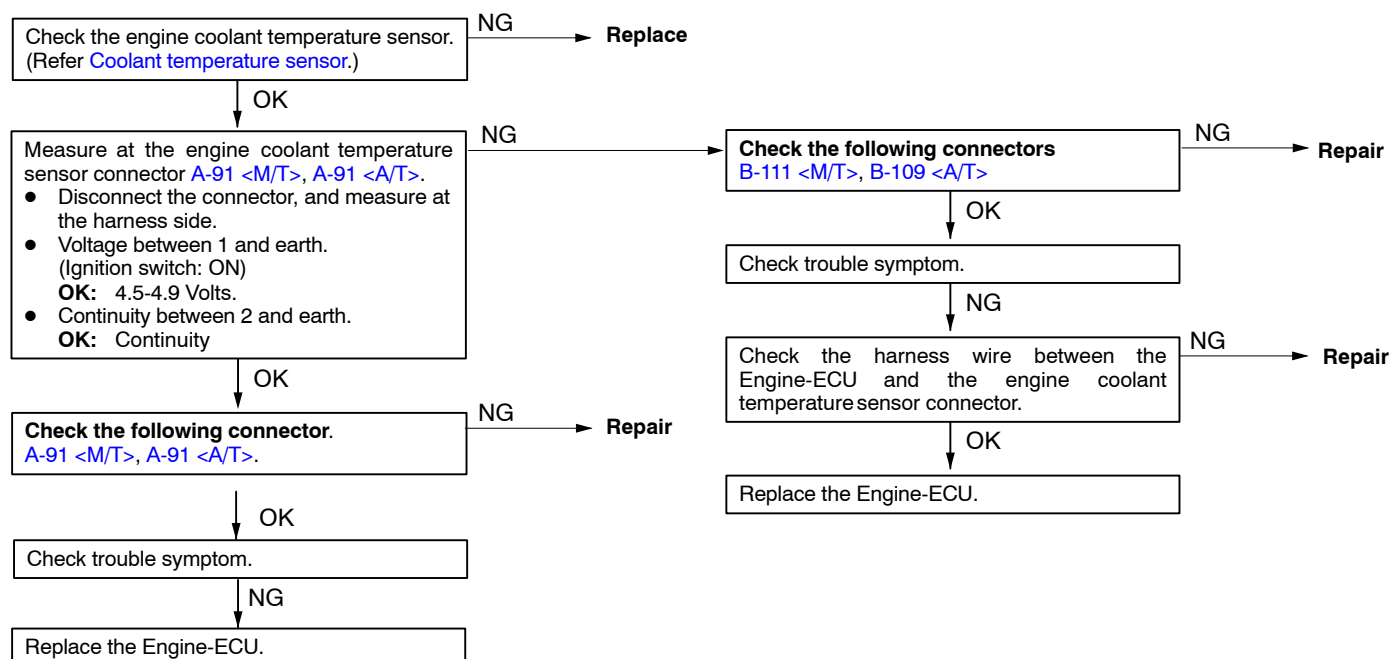
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Code No. 21 Engine coolant temperature sensor system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> Ignition switch: ON Excluding 60 seconds after the ignition is turned to ON or immediately after the engine starts. <p>Set conditions</p> <ul style="list-style-type: none"> Sensor output voltage is 4.6 V or more (corresponding to an engine coolant temperature of -45°C or less) for 4 seconds <p>or</p> <ul style="list-style-type: none"> Sensor output voltage is 0.1 V or more (corresponding to an engine coolant temperature of 140°C or more) for 4 seconds. 	<ul style="list-style-type: none"> Malfunction of the engine coolant temperature sensor Improper connector contact, open circuit or short-circuited harness wire of the intake air temperature sensor circuit Malfunction of the Engine-ECU sensor
<p>Range of Check</p> <ul style="list-style-type: none"> Ignition switch: ON Engine speed is approx. 50 rpm or more <p>Set conditions</p> <ul style="list-style-type: none"> Sensor output voltage increases from 1.6 V or less (corresponding to an engine coolant temperature of -40°C or less) to 1.6 V or more (corresponding to an engine coolant temperature of -40°C or less) After this, the sensor output voltage is 1.6 V or more for 5 minutes. 	



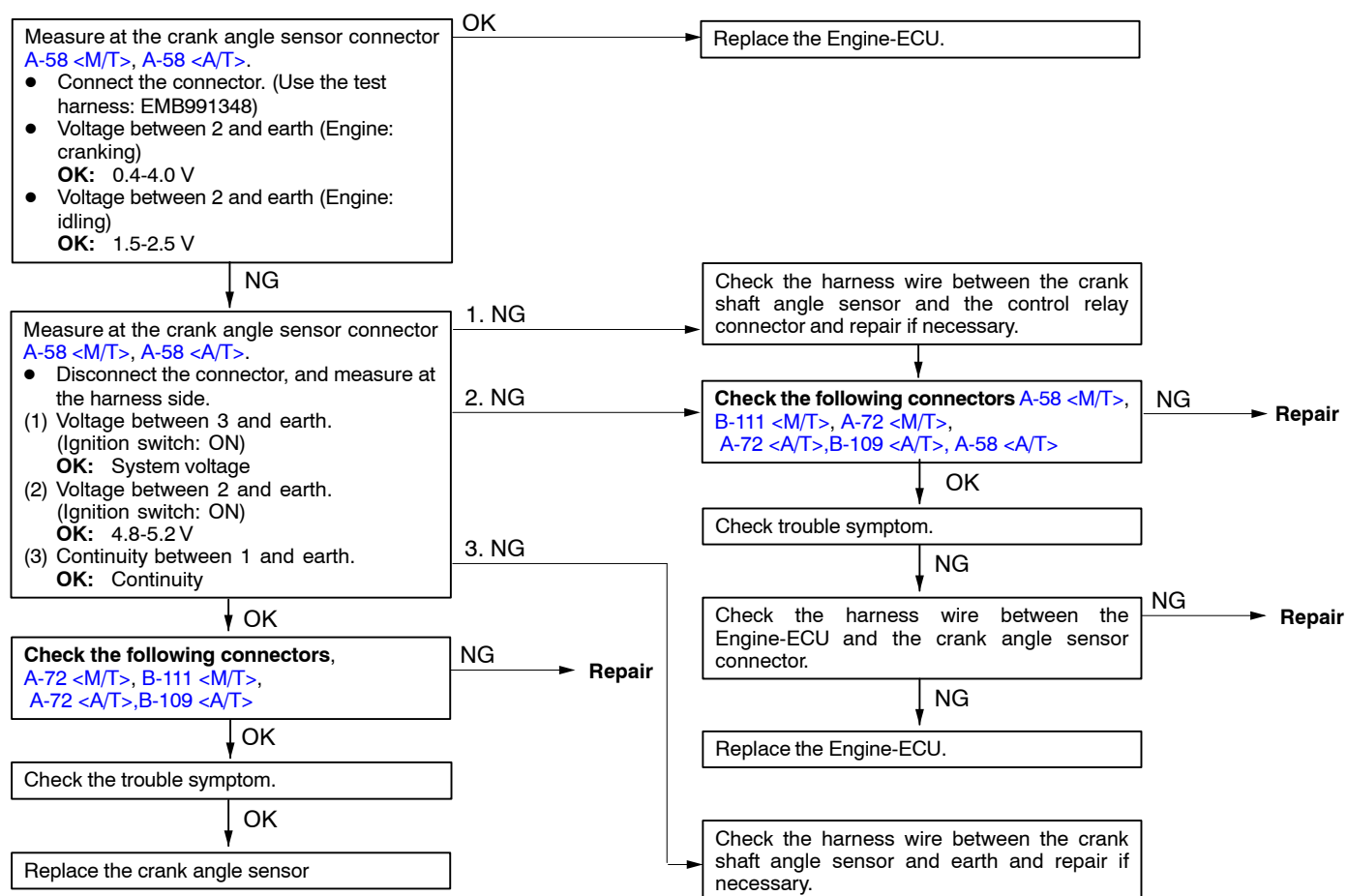
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Code No. 22 Crank angle sensor system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> Engine is cranking. <p>Set conditions</p> <ul style="list-style-type: none"> Sensor output voltage does not change for 4 seconds (no pulse signal input). 	<ul style="list-style-type: none"> Malfunction of the crank angle sensor Improper connector contact, open circuit or short-circuited harness wire of the crank angle sensor circuit. Malfunction of the Engine-ECU



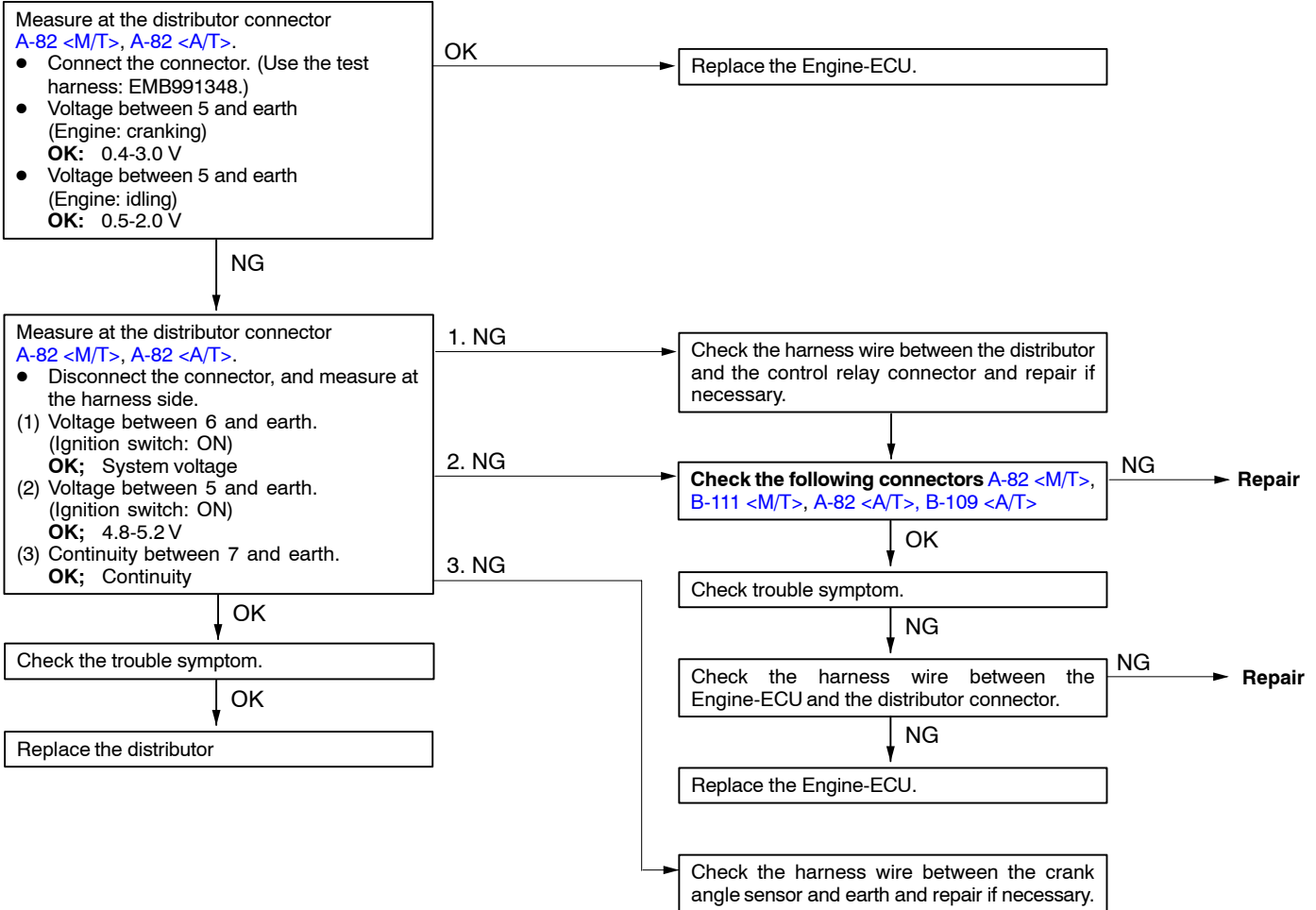
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Code No. 23 Camshaft position sensor system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> Ignition Switch: ON Engine speed is approx. 50 rpm or more. <p>Set conditions</p> <ul style="list-style-type: none"> Sensor output voltage does not change for 4 seconds (no pulse signal input). 	<ul style="list-style-type: none"> Malfunction of the crank angle sensor Improper connector contact, open circuit or short-circuited harness wire of the camshaft position sensor circuit. Malfunction of the Engine-ECU



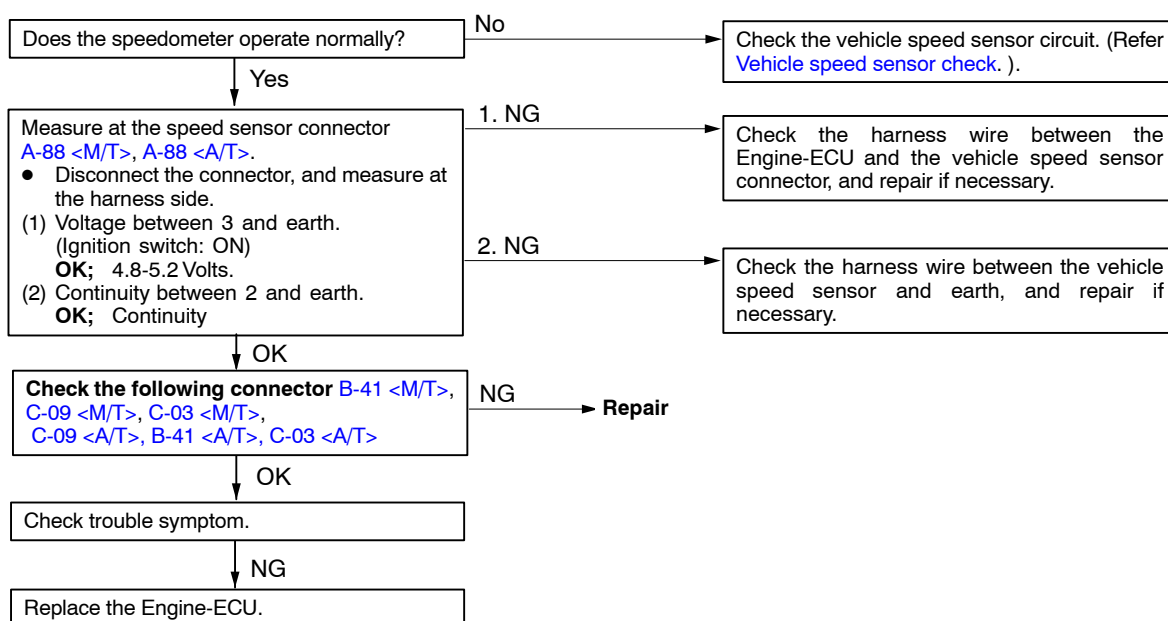
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Code No. 24 Vehicle speed sensor system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> Ignition Switch: ON Excluding 60 seconds after the ignition switch is turned to ON or immediately after the engine starts. Idle position switch: OFF Engine speed is approx. 50 rpm or more. Driving under high engine load. <p>Set conditions</p> <ul style="list-style-type: none"> Sensor output voltage does not change for 4 seconds (no pulse signal input). 	<ul style="list-style-type: none"> Malfunction of the vehicle speed sensor Improper connector contact, open circuit or short-circuited harness wire of the vehicle speed sensor circuit. Malfunction of the Engine-ECU



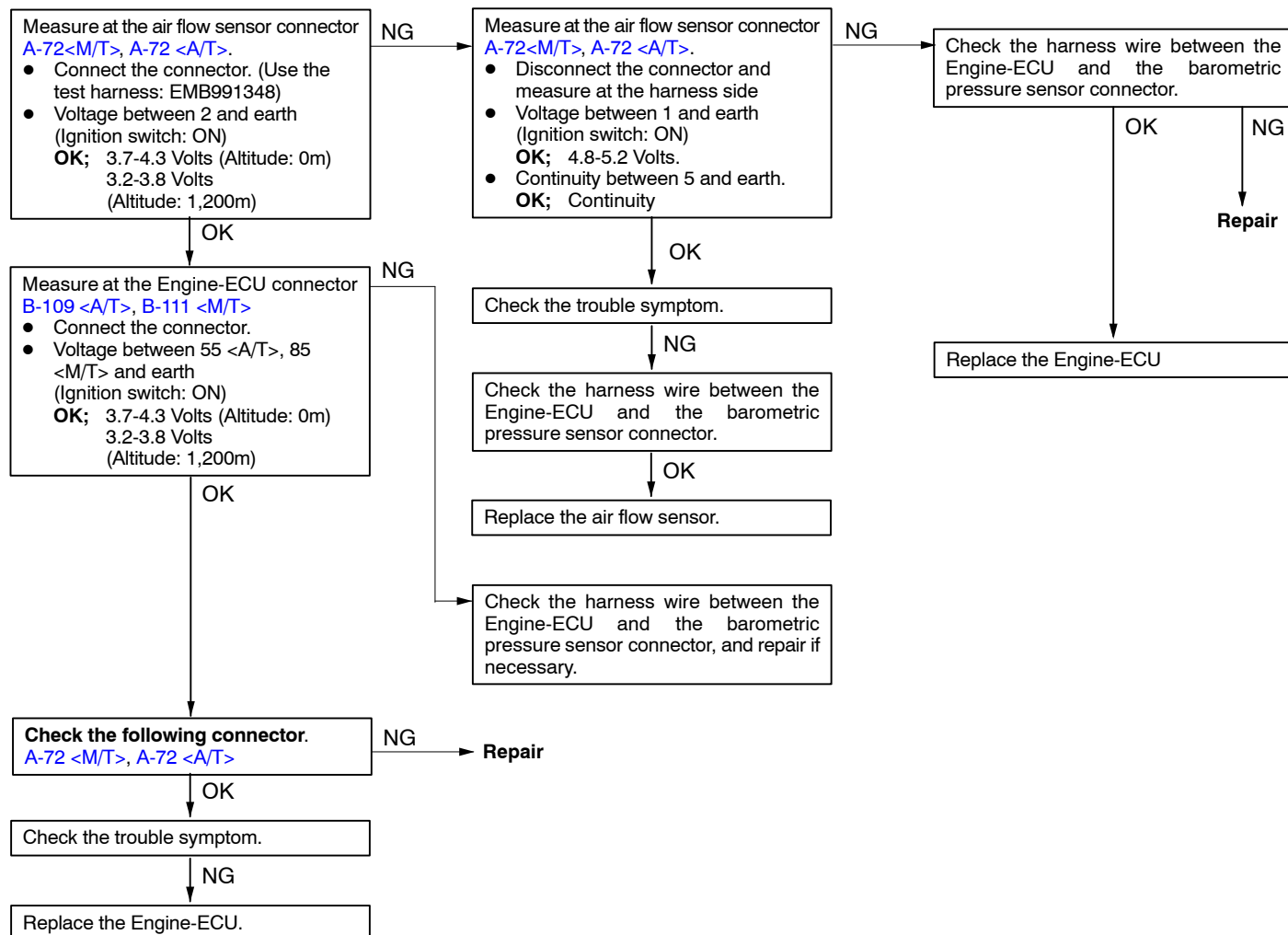
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Code No. 25 Barometric pressure sensor system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> Ignition Switch: ON Excluding 60 seconds after the ignition switch is turned ON or immediately after the engine starts. Battery voltage is 8 Volts or more <p>Set conditions</p> <ul style="list-style-type: none"> Sensor output voltage is 4.5 Volts or more (corresponding to a barometric pressure of 114 kPa or more) for 4 seconds <p>or</p> <ul style="list-style-type: none"> Sensor output voltage is 0.2 Volts or less (corresponding to a barometric pressure of 5.33 kPa or more) for 4 seconds. 	<ul style="list-style-type: none"> Malfunction of the vehicle speed sensor Improper connector contact, open circuit or short-circuited harness wire of the barometric pressure sensor circuit Malfunction of the Engine-ECU



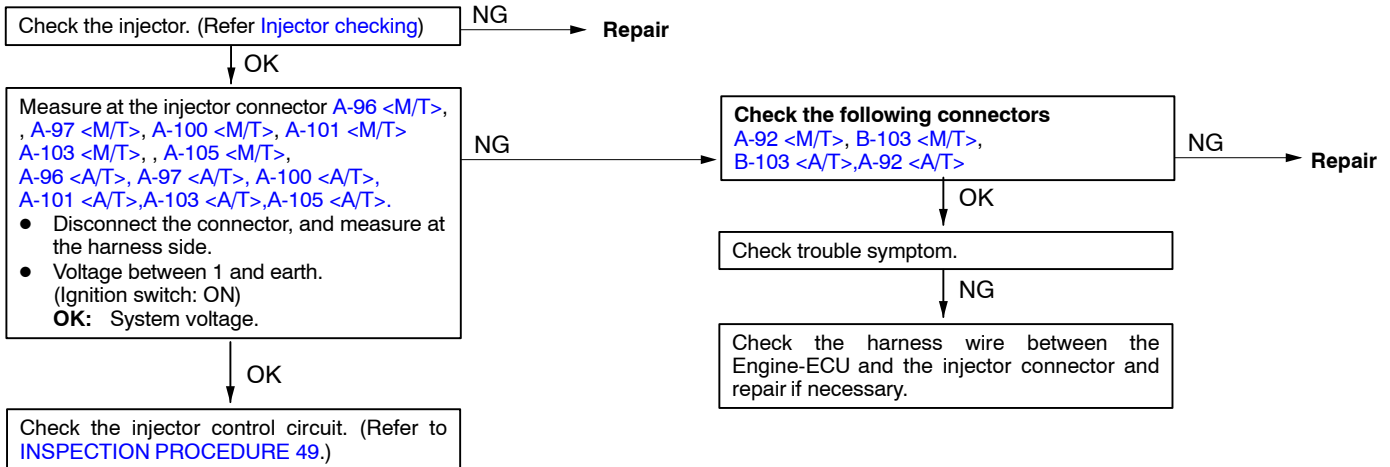
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Code No. 41 Injector system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> Engine speed is approx. 50-1000 rpm Throttle position sensor output voltage is 1.15 Volts or less. Actuator test by MUT-II is not carried out. <p>Set conditions</p> <ul style="list-style-type: none"> Surge voltage of injector coil is not detected for 4 seconds. 	<ul style="list-style-type: none"> Short circuit to earth of the diagnosis control line. Improper connector contact, open circuit or short-circuited harness wire of the injector circuit Malfunction of the Engine-ECU



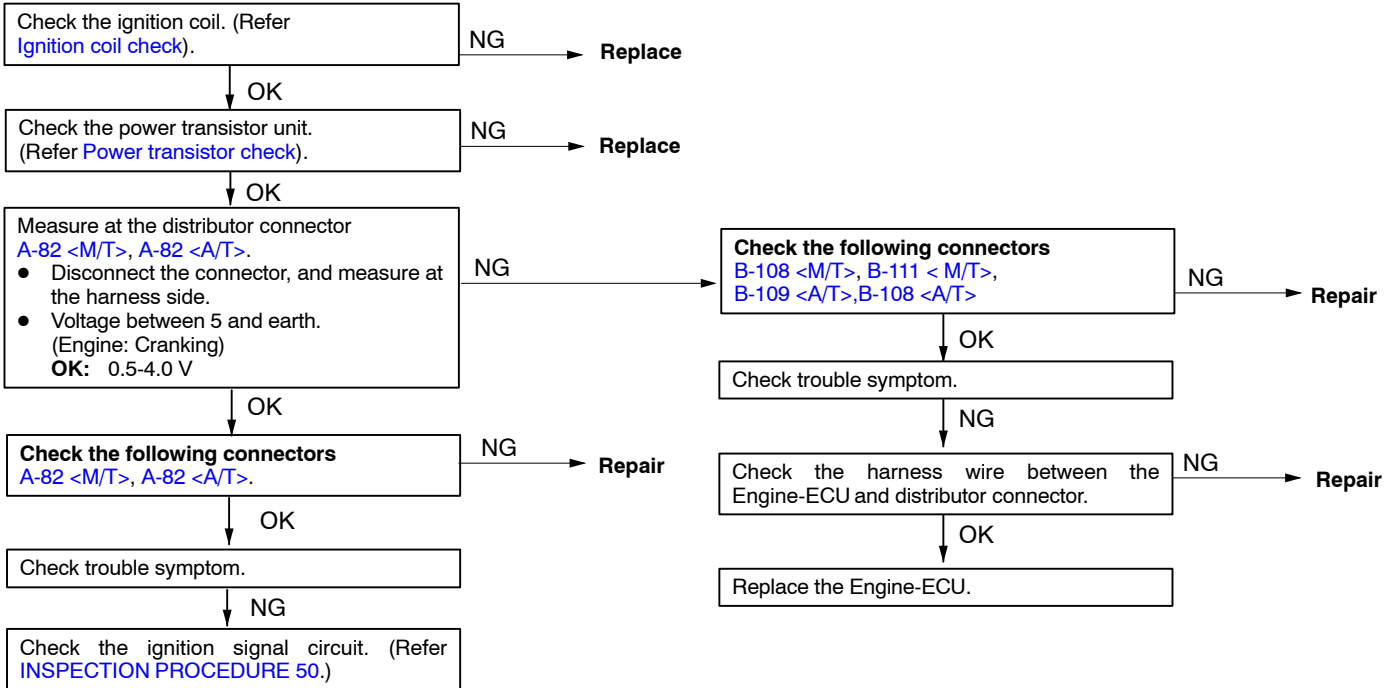
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Code No. 44 Ignition coil and power transistor unit system	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none"> Engine speed is approx. 50-4000 rpm Engine is not cranking. <p>Set conditions</p> <ul style="list-style-type: none"> The ignition signal from the same coil is not input for 4 seconds. However, this excludes cases where no ignition signal is input from any coils. 	<ul style="list-style-type: none"> Malfunction of the ignition coil. Improper connector contact, open circuit or short-circuited harness wire of the ignition primary circuit Malfunction of the power transistor unit Malfunction of the Engine-ECU



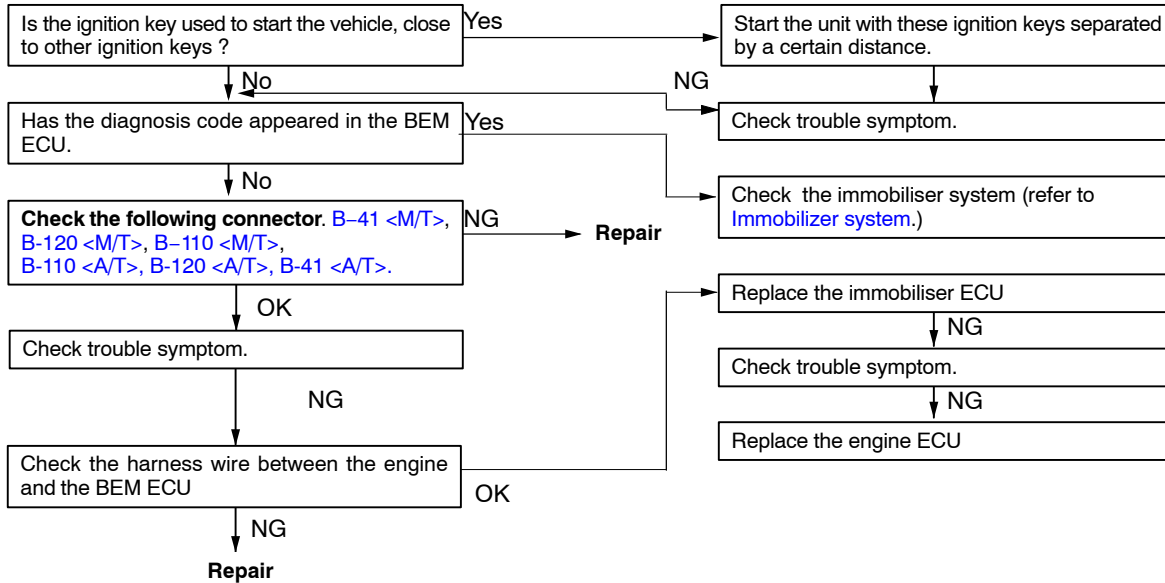
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Code No. 54 Immobiliser system	Probable cause
Range of Check <ul style="list-style-type: none"> Ignition Switch: ON Set conditions <ul style="list-style-type: none"> Failure to communicate between engine ECU and immobiliser ECU. 	<ul style="list-style-type: none"> Confusion in ID code Nonmatching of ID code Malfunction of immobiliser ECU Malfunction of harness or connector Malfunction of the Engine-ECU



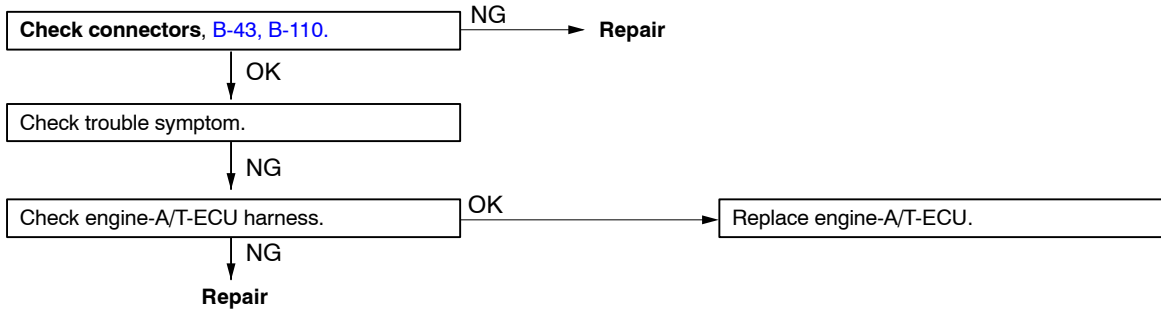
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Code No. 61 Communication with Engine-A/T-ECU System <A/T>	Probable cause
<p>Range of Check</p> <ul style="list-style-type: none">For a period of 60 sec or longer immediately after completing startupEngine revolutions approximately 50 rpm or faster <p>Set Conditions</p> <ul style="list-style-type: none">The signal from the Engine-A/T ECU requesting torque reduction has been continuously input for about 5 sec or longer	<ul style="list-style-type: none">Engine-A/T ECU faultHarness or connector fault



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Code No. 72 Vacuum Control Solenoid Valve System <Vehicles with TCL>

Probable cause

Background

- The Engine-A/T ECU checks current flow in the vacuum control solenoid circuit when the solenoid is ON and OFF.

Check Area, Judgement Criteria

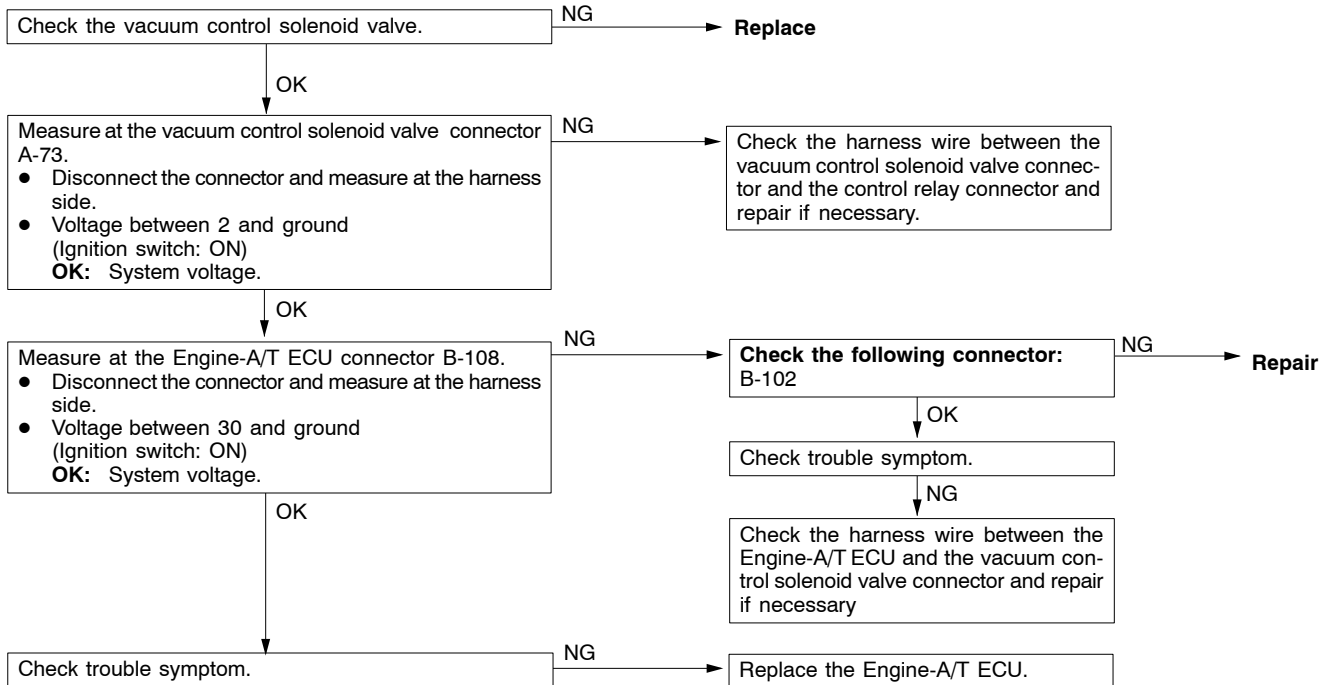
Check Area

- Ignition switch: ON.
- 60 sec or more have passed after the ignition switch was turned on or the starting sequence was completed.
- Battery voltage is 10 V or more.
- Forced actuation by means of the MUT-II is not being carried out.

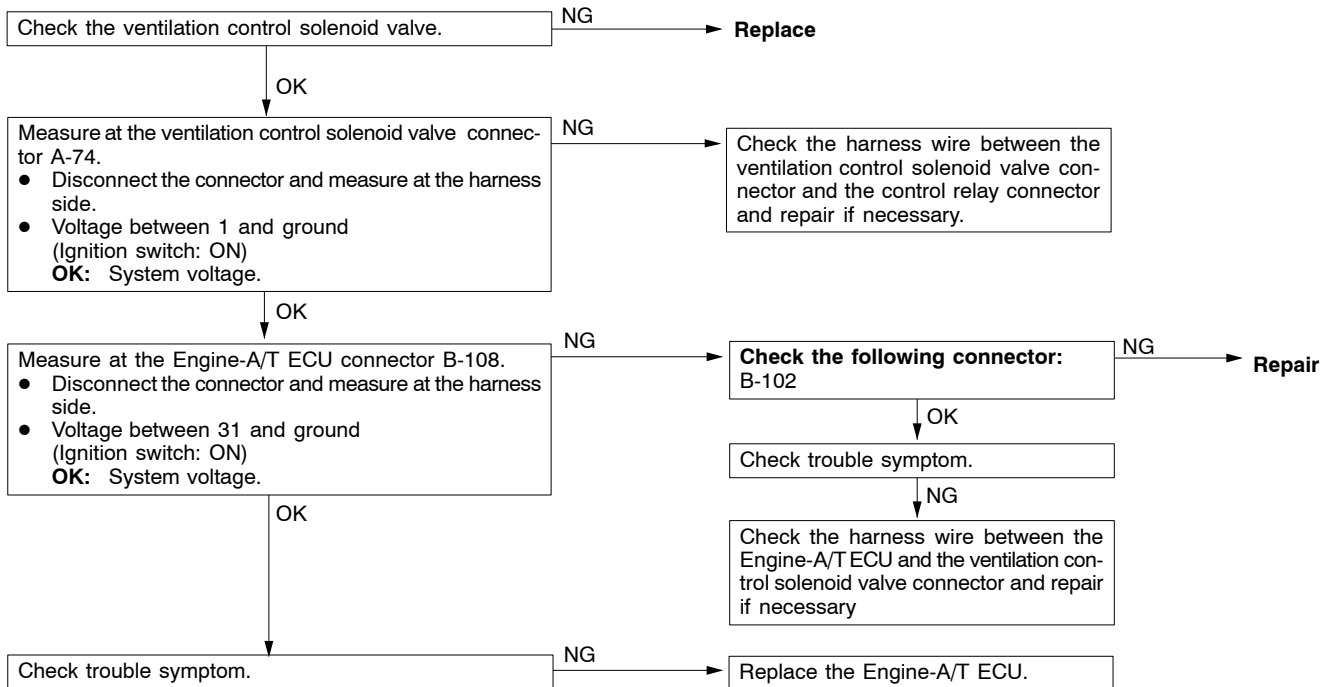
Judgement Criteria

- Solenoid coil surge voltage (system voltage +2V) is not detected when the solenoid valve is turned ON/OFF.

- Malfunction of the vacuum control solenoid valve
- Improper connector contact, open circuit or short-circuited harness wire of the vacuum control solenoid valve
- Engine-A/T ECU failed



Code No. 73 Ventilation Control Solenoid Valve System <Vehicles with TCL>	Probable cause
<p>Background</p> <ul style="list-style-type: none"> The Engine-A/T ECU checks current flow in the ventilation control solenoid circuit when the solenoid is ON and OFF. <p>Check Area, Judgement Criteria</p> <p>Check Area</p> <ul style="list-style-type: none"> Ignition switch: ON. 60 sec or more have passed after the ignition switch was turned on or the starting sequence was completed. Battery voltage is 10 V or more. Forced actuation by means of the MUT-II is not being carried out. <p>Judgement Criteria</p> <ul style="list-style-type: none"> Solenoid coil surge voltage (system voltage +2V) is not detected when the solenoid valve is turned ON/OFF. 	<ul style="list-style-type: none"> Malfunction of the ventilation control solenoid valve Improper connector contact, open circuit or short-circuited harness wire of the ventilation control solenoid valve Engine-A/T ECU failed



INSPECTION CHART FOR TROUBLE SYMPTOMS

Trouble symptom		Inspection procedure No.
Communication with MUT-II is impossible.	Communication with all systems is not possible.	1
	Communication with Engine-ECU only is not possible.	2
Check engine/malfunction indicator lamp and related parts	The engine warning lamp does not illuminate right after the ignition switch is turned to the ON position.	3
	The engine warning lamp remains illuminated and never goes out.	4
Starting	Cranks, won't start	5
	Fires up and dies	6
	Hard starting	7
Idling stability (Improper idling)	Unstable idle. (Rough idle, hunting)	8
	Idle speed is high. (Improper idle speed)	9
	Idle speed is low. (Improper idle speed)	10
Idling stability (Engine stalls)	When the engine is cold, it stalls at idle (Die out)	11
	When the engine becomes hot, it stalls at idle. (Die out)	12
	The engine stalls when accelerating. (Pass out)	13
	The engine stalls when decelerating.	14
Driving	Hesitation, sag or stumble	15
	Acceleration shock	16
	Deceleration shock	17
	Poor acceleration	18
	Surge	19
	Knocking	20
Dieseling (Run on)		21
Too high CO and HC concentration when idling		22

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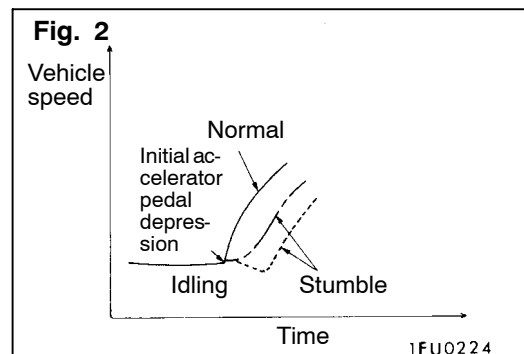
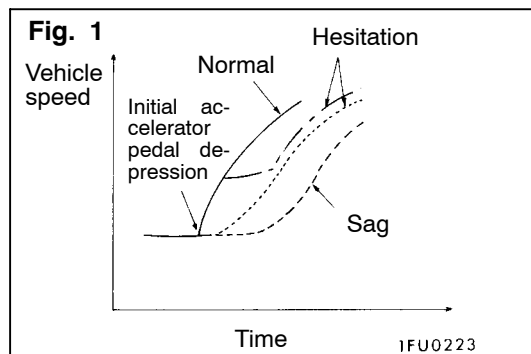
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PROBLEM SYMPTOMS TABLE (FOR YOUR INFORMATION)

Items		Symptom
Starting	Won't start	The starter is used to crank the engine, but there is no combustion within the cylinders, and the engine won't start.
	Fires up and dies	There is combustion within the cylinders, but then the engine soon stalls.
	Hard starting	Engine starts after cranking a while.
Idling stability	Hunting	Engine speed doesn't remain constant; changes at idle.
	Rough idle	Usually, a judgement can be based upon the movement of the tachometer pointer, and the vibration transmitted to the steering wheel, shift lever, body, etc. This is called rough idle.
	Incorrect idle speed	The engine doesn't idle at the usual correct speed.
	Engine stall (Die out)	The engine stalls when the foot is taken from the accelerator pedal, regardless of whether the vehicle is moving or not.
	Engine stall (Pass out)	The engine stalls when the accelerator pedal is depressed or while it is being used.
Driving	Hesitation Sag	"Hesitation" is the delay in response of the vehicle speed (engine speed) that occurs when the accelerator is depressed in order to accelerate from the speed at which the vehicle is now travelling, or a temporary drop in vehicle speed (engine speed) during such acceleration. Serious hesitation is called "sag". (Refer to Fig. 1)
	Poor acceleration	Poor acceleration is inability to obtain an acceleration corresponding to the degree of throttle opening, even though acceleration is smooth, or the inability to reach maximum speed.
	Stumble	Engine speed increase is delayed when the accelerator pedal is initially depressed for acceleration. (Refer to Fig. 2)
	Shock	The feeling of a comparatively large impact or vibration when the engine is accelerated or decelerated.
	Surge	This is slight acceleration and deceleration feel usually steady, light throttle cruise. Most notable under light loads.
	Knocking	A sharp sound like a hammer striking the cylinder walls during driving and which adversely affects driving.
Stopping	Run on ("Dieseling")	The condition in which the engine continues to run after the ignition switch is turned to OFF. Also called "Dieseling".

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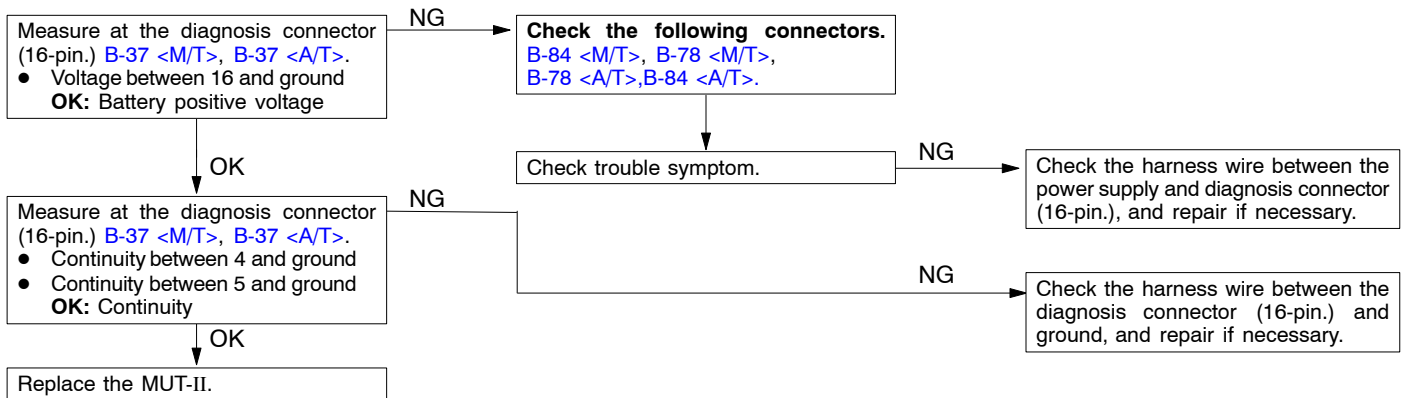
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INSPECTION PROCEDURE FOR TROUBLE SYMPTOMS

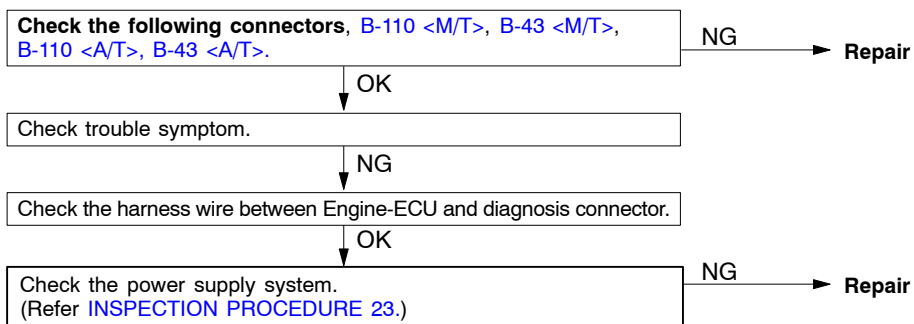
INSPECTION PROCEDURE 1

Communication with MUT-II is not possible. (Communication with all systems is not possible.)	Probable cause
The cause is probably a defect in the power supply system (including ground) for the diagnosis line.	<ul style="list-style-type: none"> Malfunction of the connector Malfunction of the harness wire



INSPECTION PROCEDURE 2

MUT-II communication with Engine-ECU is not possible.	Probable cause
One of the following causes may be suspected. <ul style="list-style-type: none"> No power supply to Engine-ECU Defective ground circuit of Engine-ECU Defective Engine-ECU Improper communication line between Engine-ECU and MUT-II 	<ul style="list-style-type: none"> Malfunction of Engine-ECU power supply circuit Malfunction of the Engine-ECU Open circuit between Engine-ECU and diagnosis connector



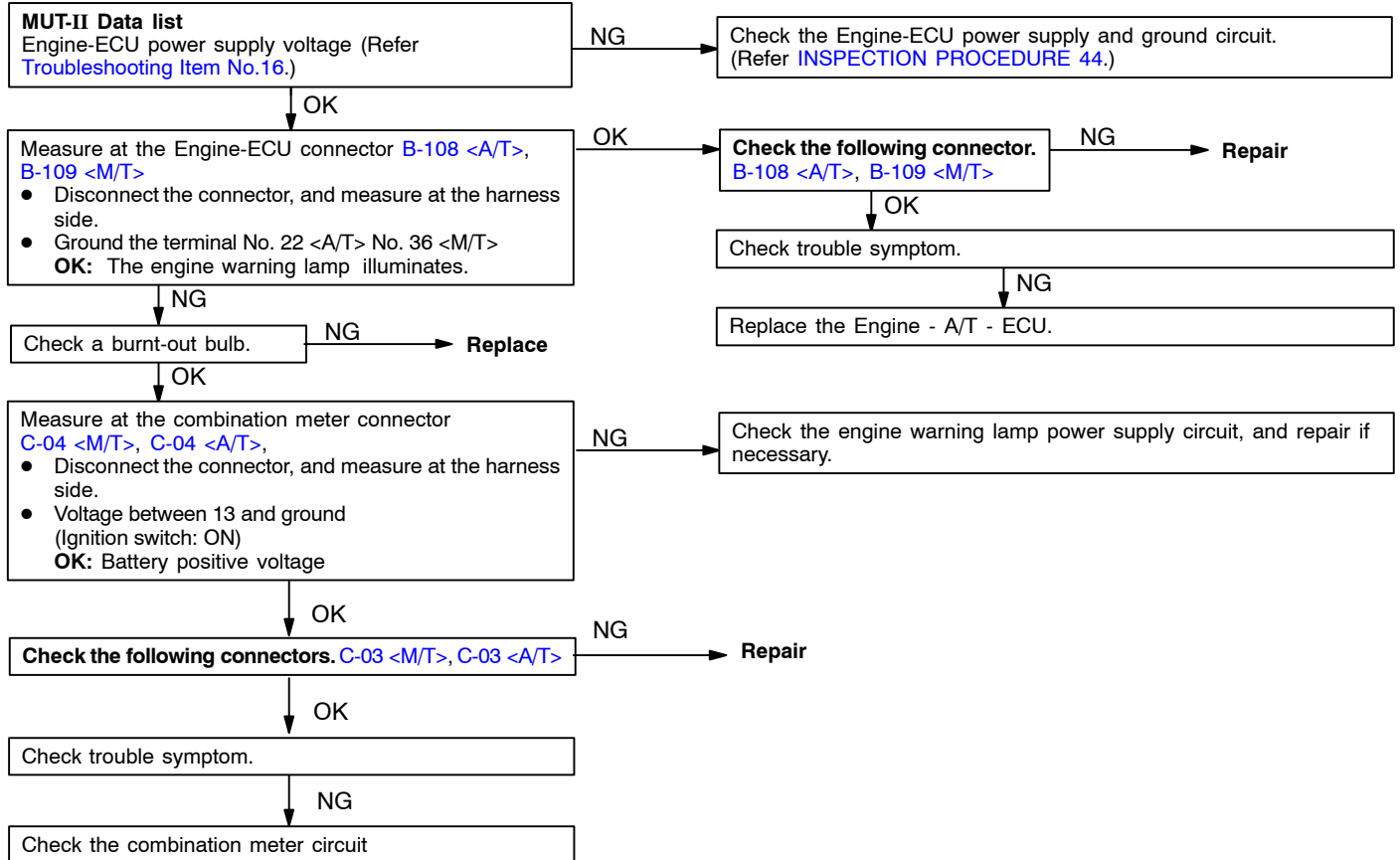
INSPECTION PROCEDURE 3

The engine warning lamp does not illuminate right after the ignition switch is turned to the ON position.	Probable cause
Because maybe a burnt-out bulb, the Engine-ECU causes the engine warning lamp to illuminate for five seconds immediately after the ignition switch is turned to ON. If the engine warning lamp does not illuminate immediately after the ignition switch is turned to ON, one of these listed at right has probably occurred.	<ul style="list-style-type: none"> Burnt-out bulb Defective engine warning lamp circuit Malfunction of the Engine-ECU

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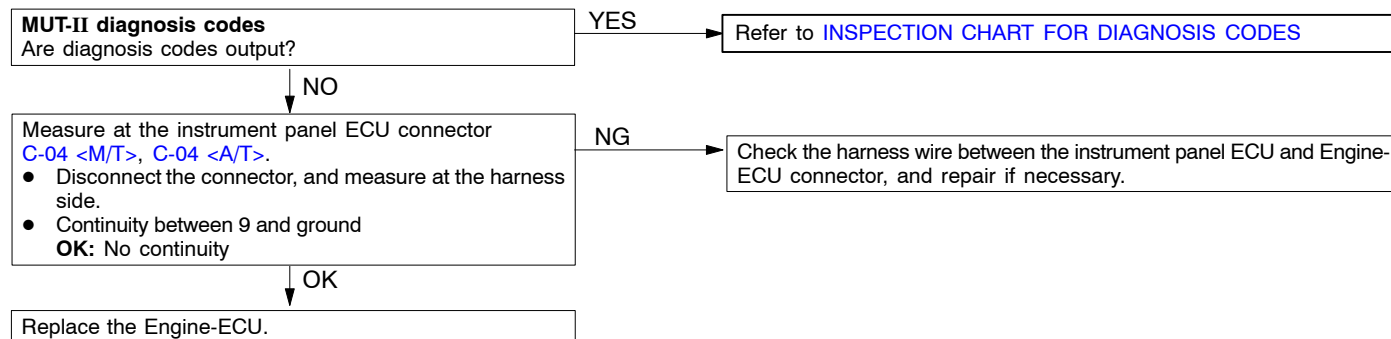
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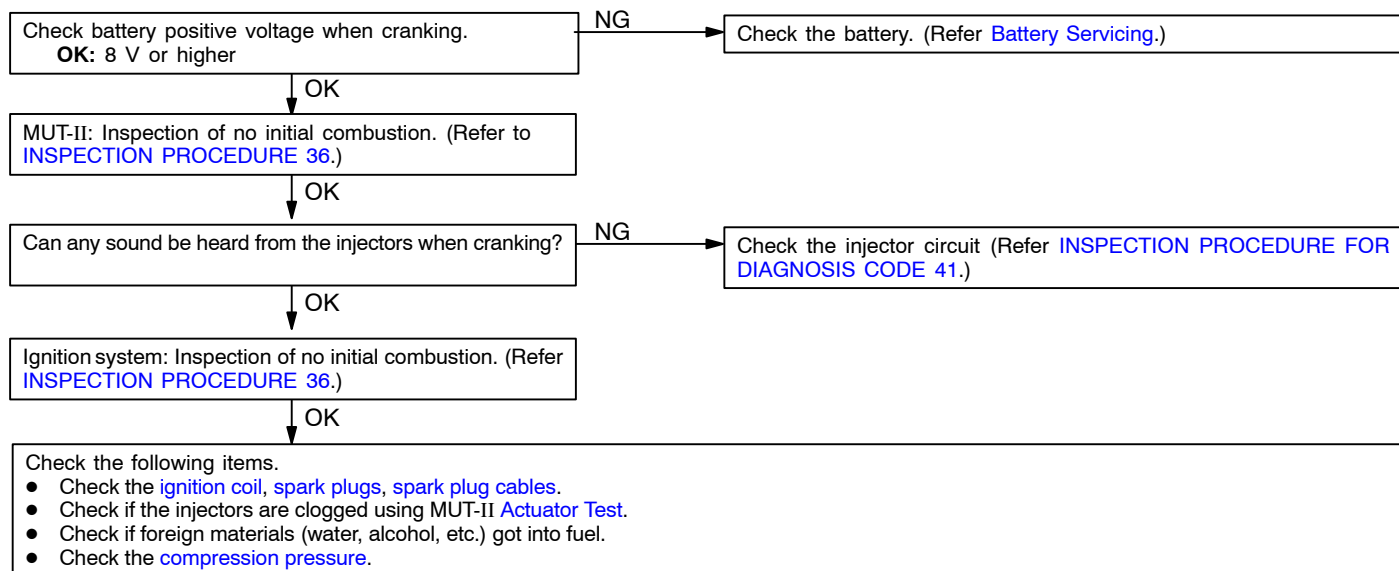
INSPECTION PROCEDURE 4

The engine warning lamp remains illuminated.	Probable cause
In cases such as the above, the cause is probably that the Engine-ECU is detecting a problem in a sensor or actuator, or that one of these listed at right has occurred.	<ul style="list-style-type: none"> Short-circuit between the check engine lamp and Engine-ECU Malfunction of the Engine-ECU



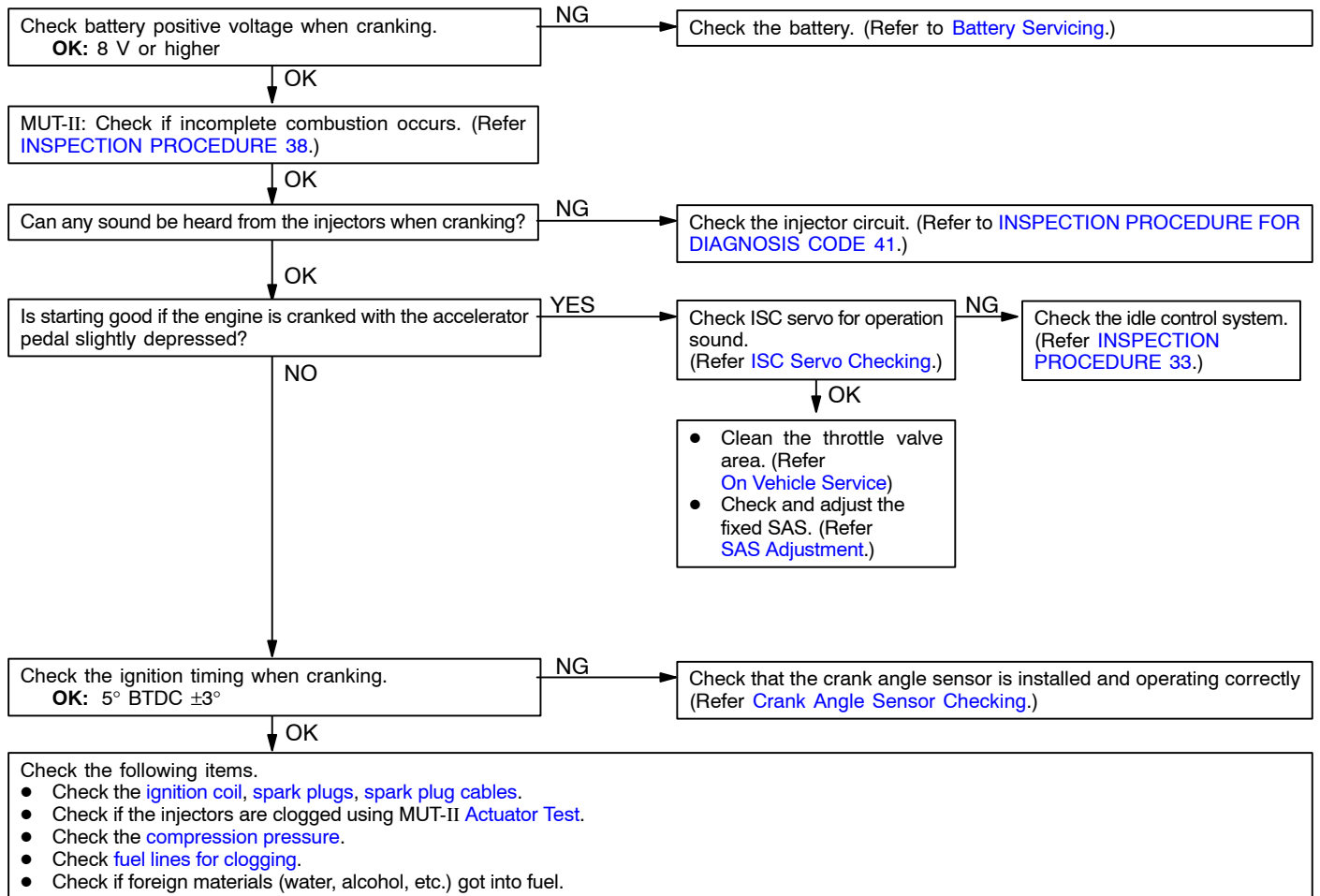
INSPECTION PROCEDURE 5

Cranks, won't start	Probable cause
In cases such as the above, the cause is probably that a spark plug is defective, or that the supply of fuel to the combustion chamber is defective. In addition, foreign materials (water, kerosene, etc.) may be mixed with the fuel.	<ul style="list-style-type: none"> Malfunction of the ignition system Malfunction of the fuel pump system Malfunction of the injectors Malfunction of the Engine-ECU Foreign materials in fuel



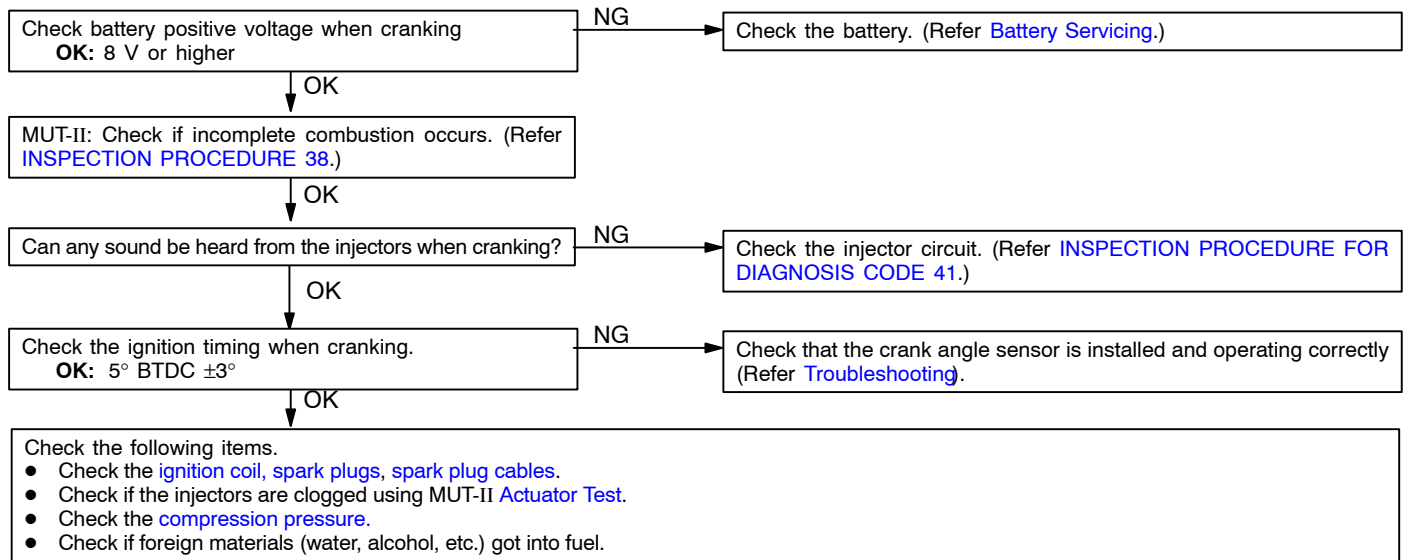
INSPECTION PROCEDURE 6

Fires up and dies.	Probable cause
In such cases as the above, the cause is probably that the spark plugs are generating sparks but the sparks are weak, or the initial mixture for starting is not appropriate.	<ul style="list-style-type: none"> • Malfunction of the ignition system • Malfunction of the injector system • Foreign materials in fuel • Poor compression • Malfunction of the Engine-ECU



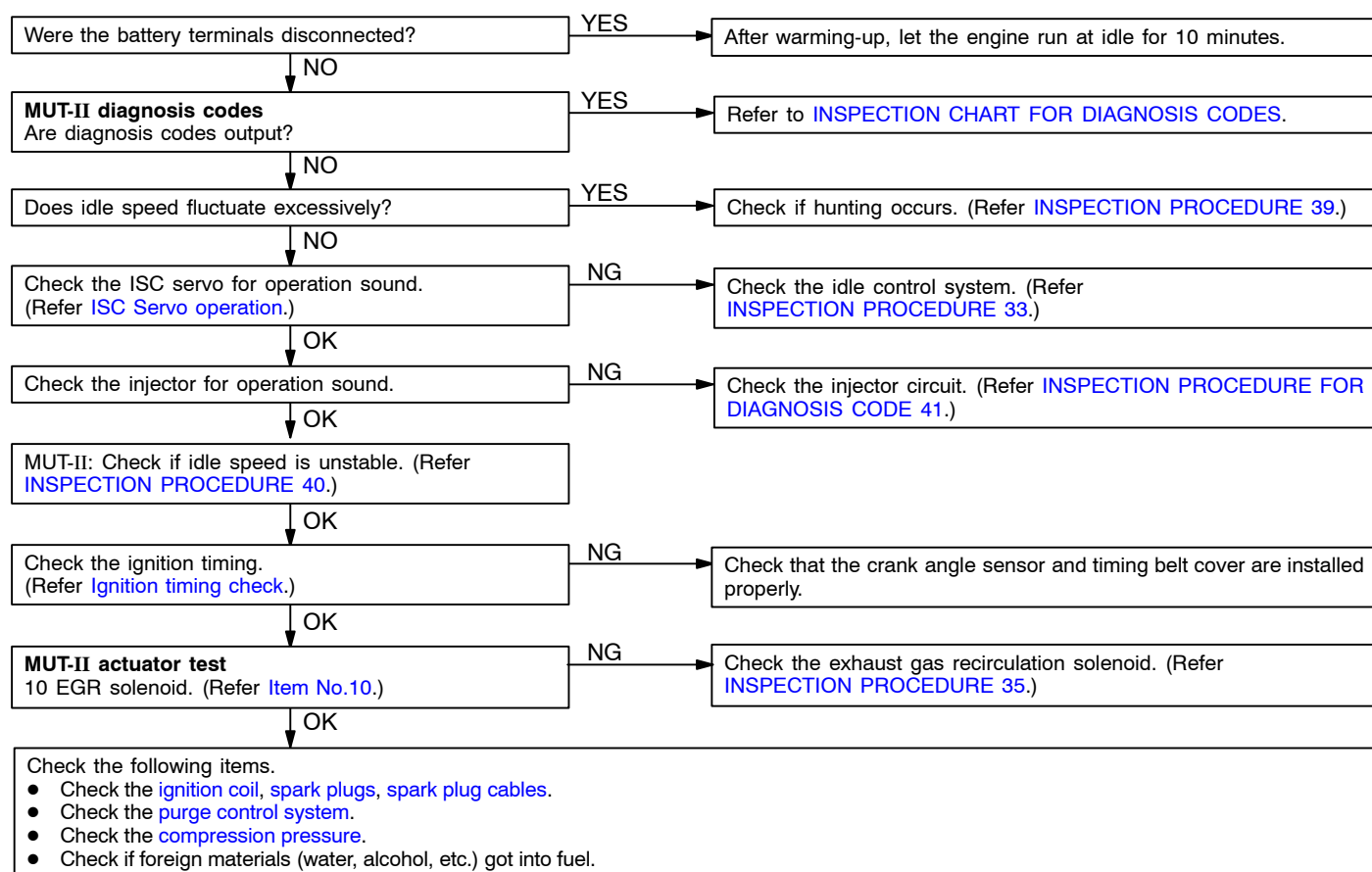
INSPECTION PROCEDURE 7

Hard starting.	Probable cause
In cases such as the above, the cause is probably that the spark is weak and ignition is difficult, the initial mixture for starting is not appropriate, or sufficient compression pressure is not being obtained.	<ul style="list-style-type: none"> • Malfunction of the ignition system • Malfunction of the injector system • Inappropriate gasoline use • Poor compression



INSPECTION PROCEDURE 8

Unstable idle (Rough idle, hunting)	Probable cause
<p>In cases such as the above, the cause is probably that the ignition system, air/fuel mixture, ISC servo or compression pressure is defective.</p> <p>Because the range of possible causes is broad, inspection is narrowed down to simple items.</p>	<ul style="list-style-type: none"> • Malfunction of the ignition system • Malfunction of air-fuel ratio control system • Malfunction of the ISC system • Malfunction of the purge solenoid valve system • Poor compression • Drawing air into exhaust system • Malfunction of the EGR solenoid valve system



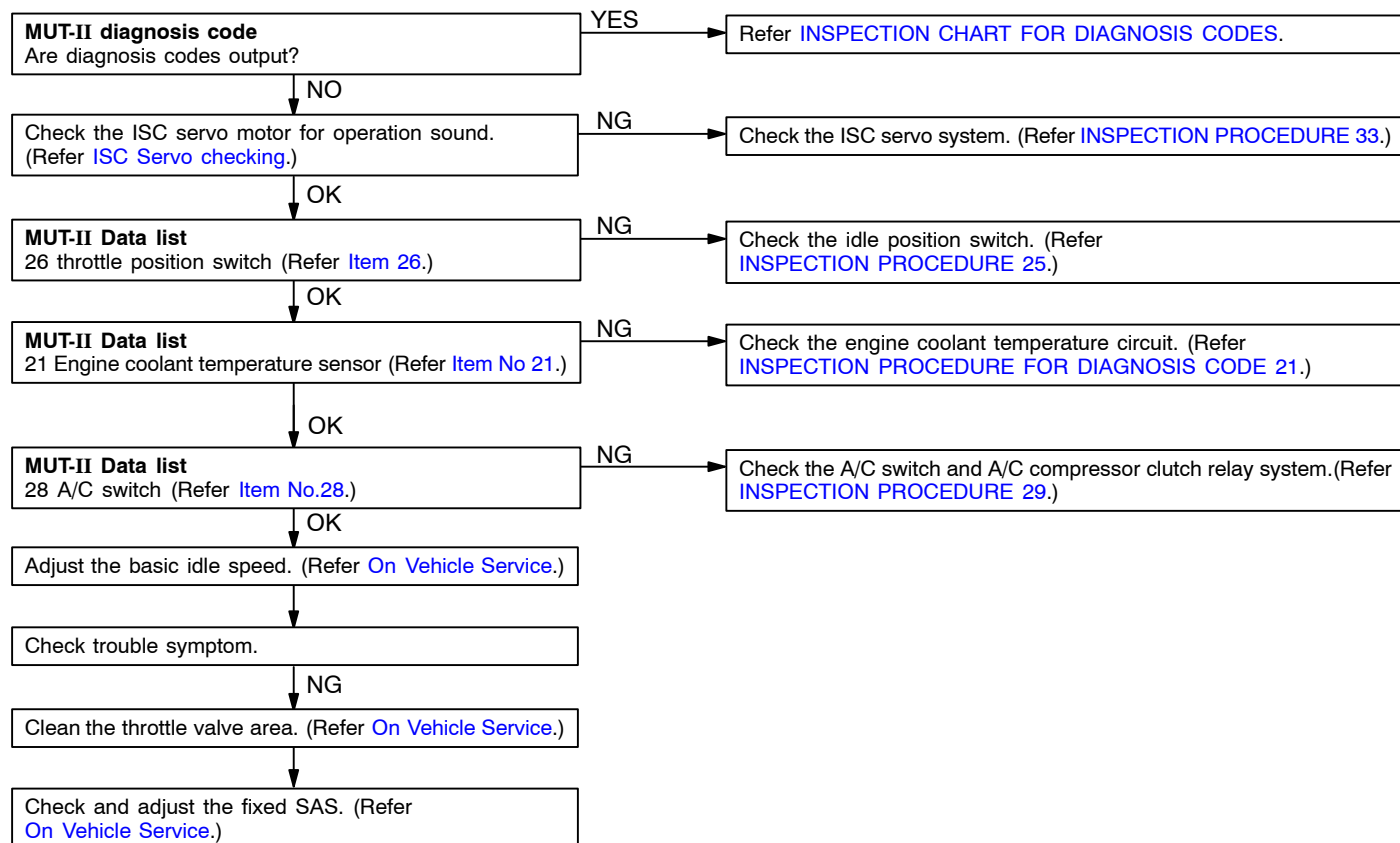
INSPECTION PROCEDURE 9

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Idle speed is high. (Improper idle speed)	Probable cause
In such cases as the above, the cause is probably that the intake air volume during idle is too great.	<ul style="list-style-type: none"> Malfunction of the ISC servo motor system Malfunction of the throttle body



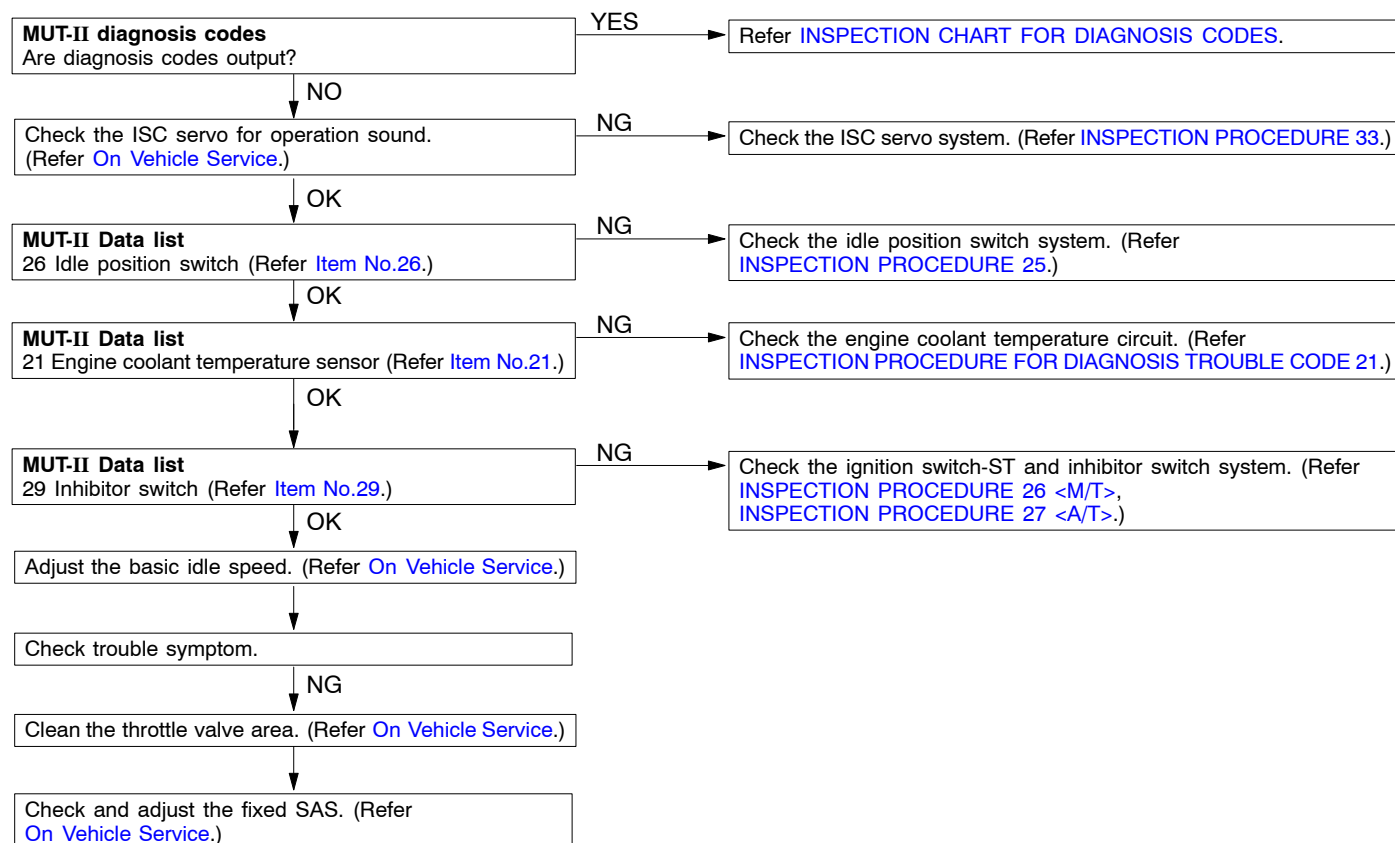
INSPECTION PROCEDURE 10

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Idle speed is low. (Improper idle speed)	Probable cause
In cases such as the above, the cause is probably that the intake air volume during idling is too small.	<ul style="list-style-type: none"> Malfunction of the ISC servo system Malfunction of the throttle body



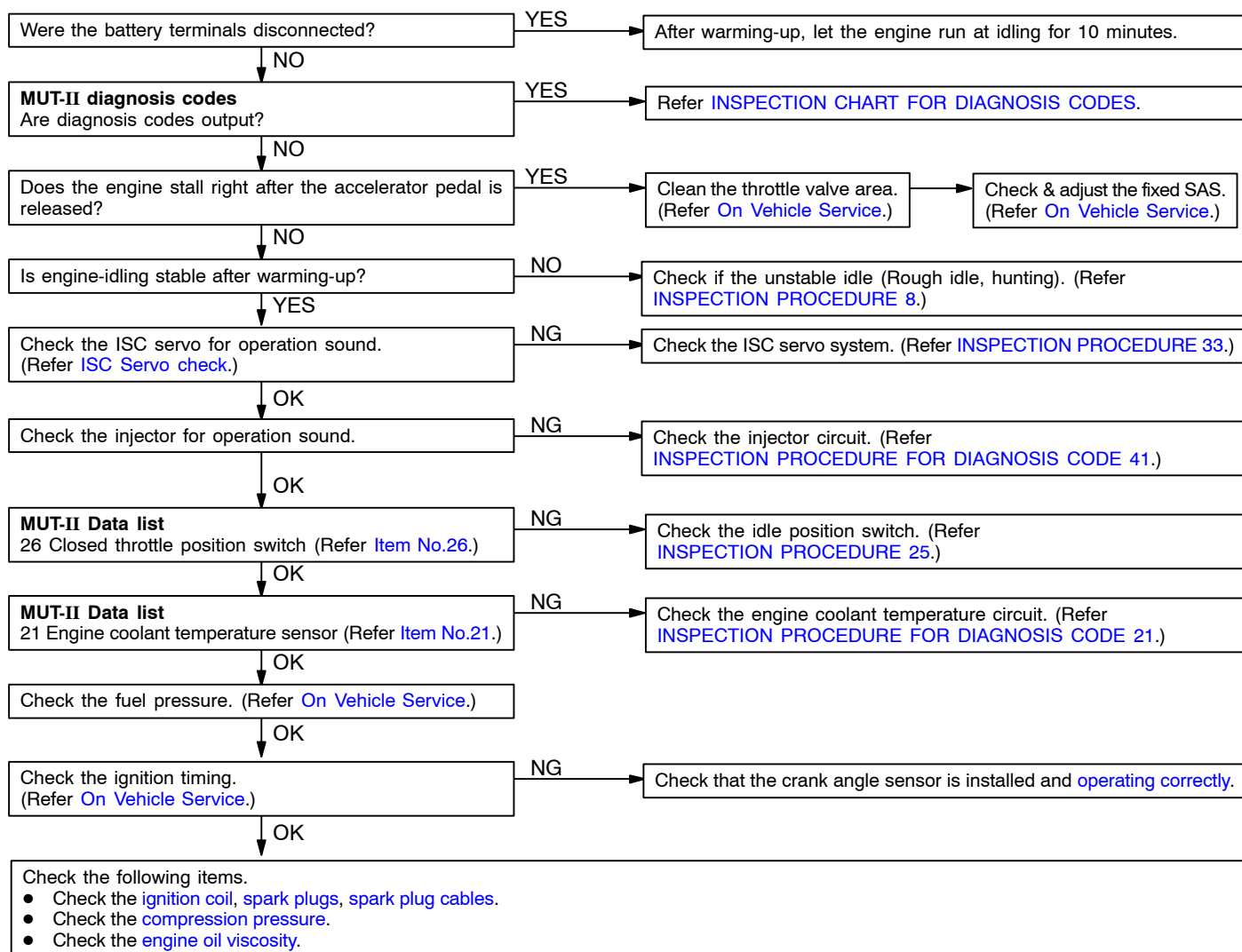
INSPECTION PROCEDURE 11

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When the engine is cold, it stalls at idle. (Die out)	Probable cause
In such cases as the above, the cause is probably that the air/fuel mixture is inappropriate when the engine is cold, or that the intake air volume is insufficient.	<ul style="list-style-type: none"> • Malfunction of the ISC servo system • Malfunction of the throttle body • Malfunction of the injector system • Malfunction of the ignition system



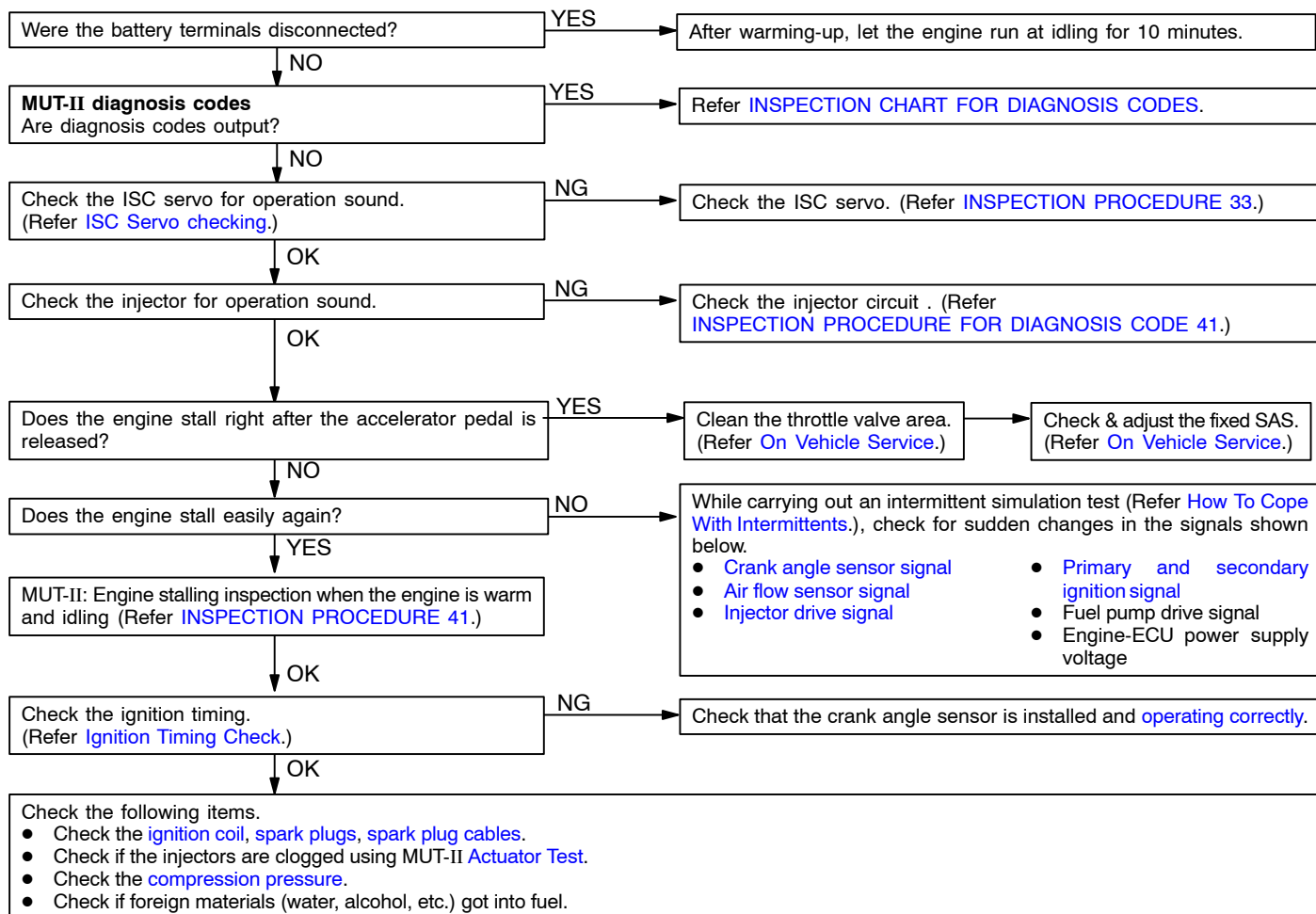
INSPECTION PROCEDURE 12

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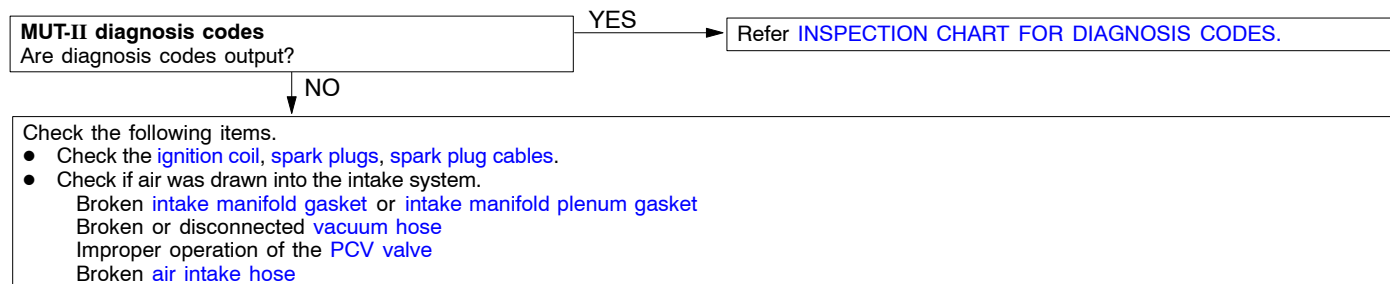
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When the engine is hot, it stalls at idle. (Die out)	Probable cause
In cases such as the above, the cause is probably that ignition system, air/fuel mixture, ISC servo or compression pressure is defective. In addition, if the engine suddenly stalls, the cause may also be a defective connector contact.	<ul style="list-style-type: none"> • Malfunction of the ignition system • Malfunction of air-fuel ratio control system • Malfunction of the ISC system • Drawing air into intake system • Improper connector contact



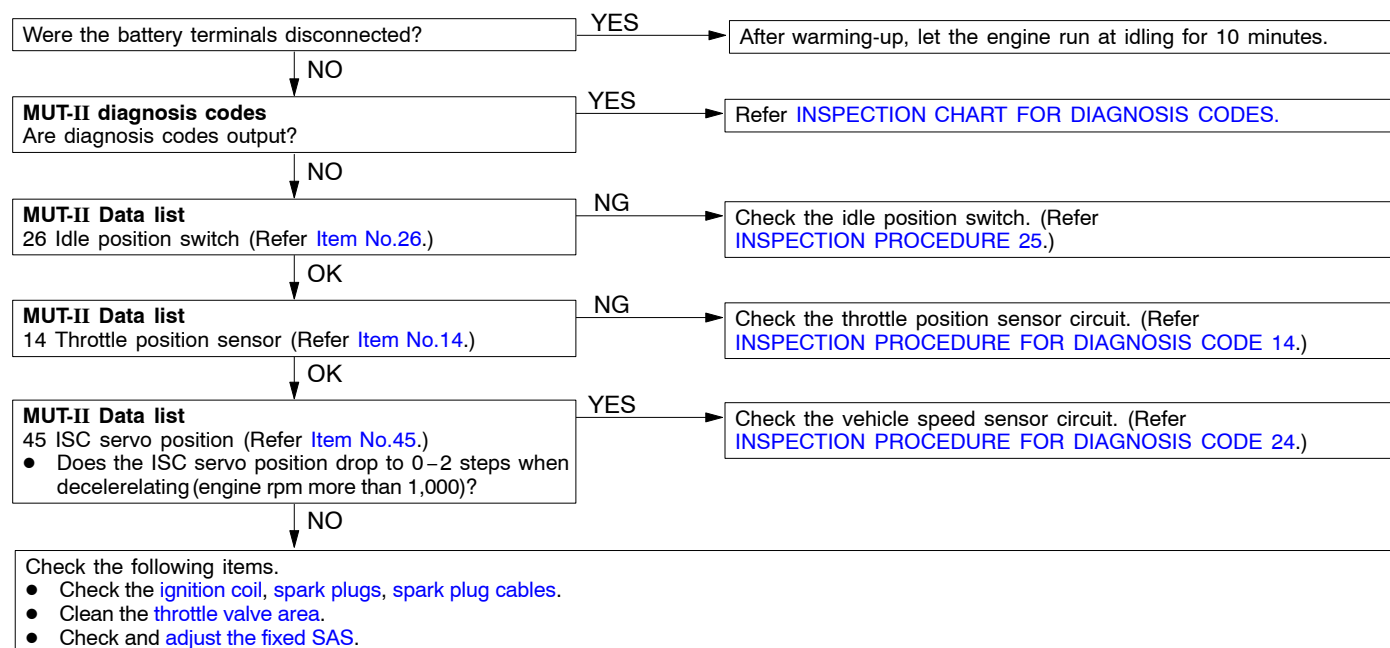
INSPECTION PROCEDURE 13

The engine stalls when accelerating. (Pass out)	Probable cause
In cases such as the above, the cause is probably misfiring due to a weak spark, or an inappropriate air/fuel mixture when the accelerator pedal is depressed.	<ul style="list-style-type: none"> Drawing air into intake system Malfuction of the ignition system



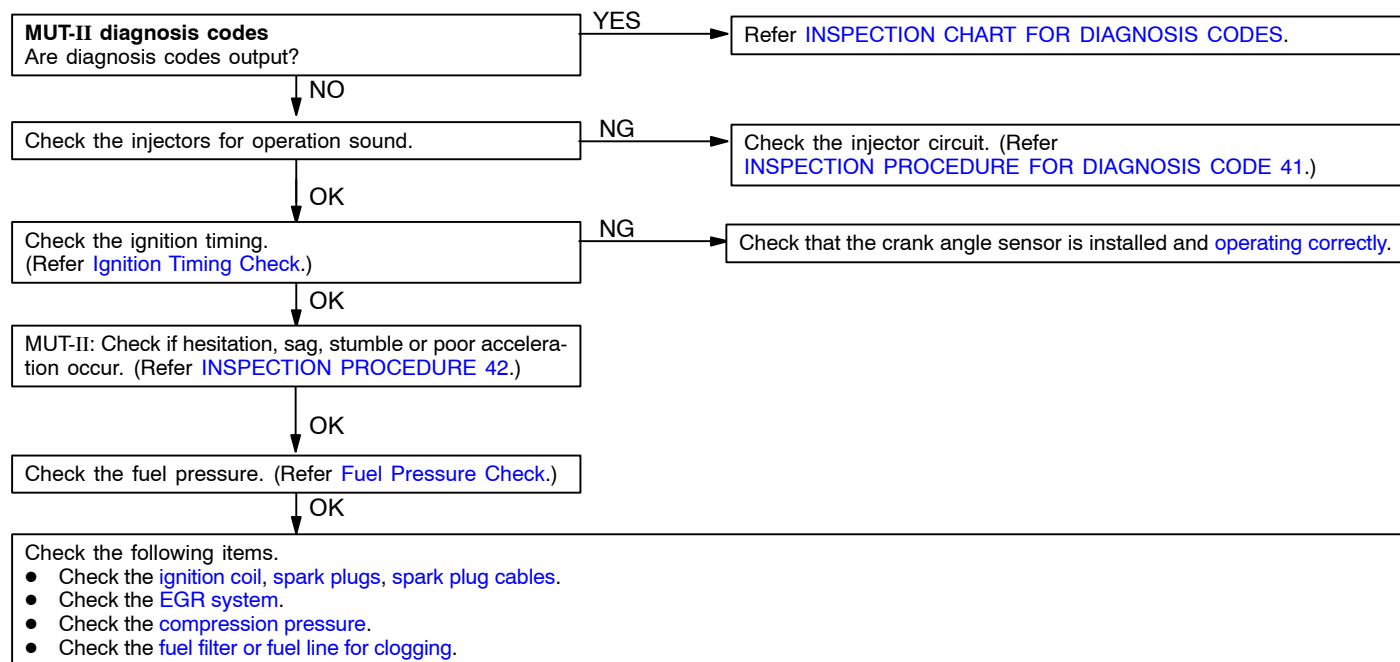
INSPECTION PROCEDURE 14

The engine stalls when decelerating.	Probable cause
In cases such as the above, the cause is probably that the intake air volume is insufficient due to a defective ISC servo system.	<ul style="list-style-type: none"> Malfuction of the ISC servo system



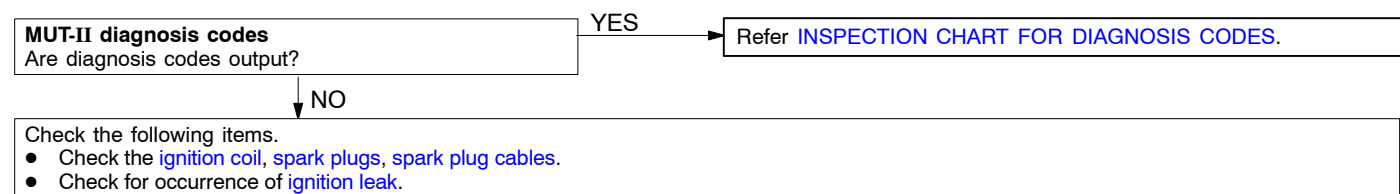
INSPECTION PROCEDURE 15

Hesitation, sag or stumble	Probable cause
In cases such as the above, the cause is probably that ignition system, air/fuel mixture or compression pressure is defective.	<ul style="list-style-type: none"> Malfunction of the ignition system Malfunction of air-fuel ratio control system Malfunction of the fuel supply system Malfunction of the EGR solenoid system Poor compression



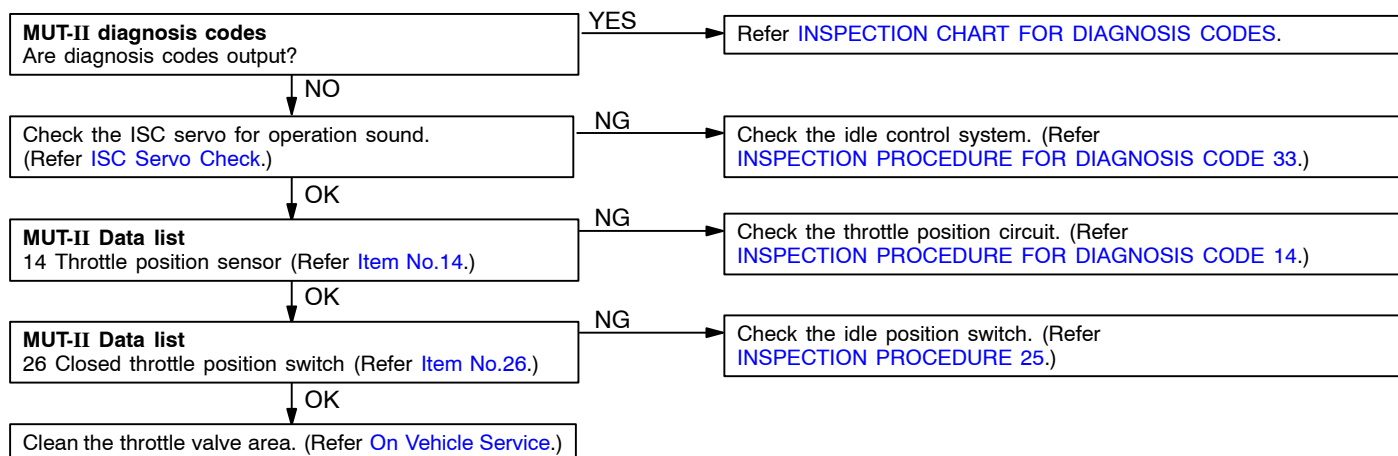
INSPECTION PROCEDURE 16

Acceleration shock	Probable cause
In cases such as the above, the cause is probably that there is an ignition leak accompanying the increase in the spark plug demand voltage during acceleration.	<ul style="list-style-type: none"> Malfunction of the ignition system



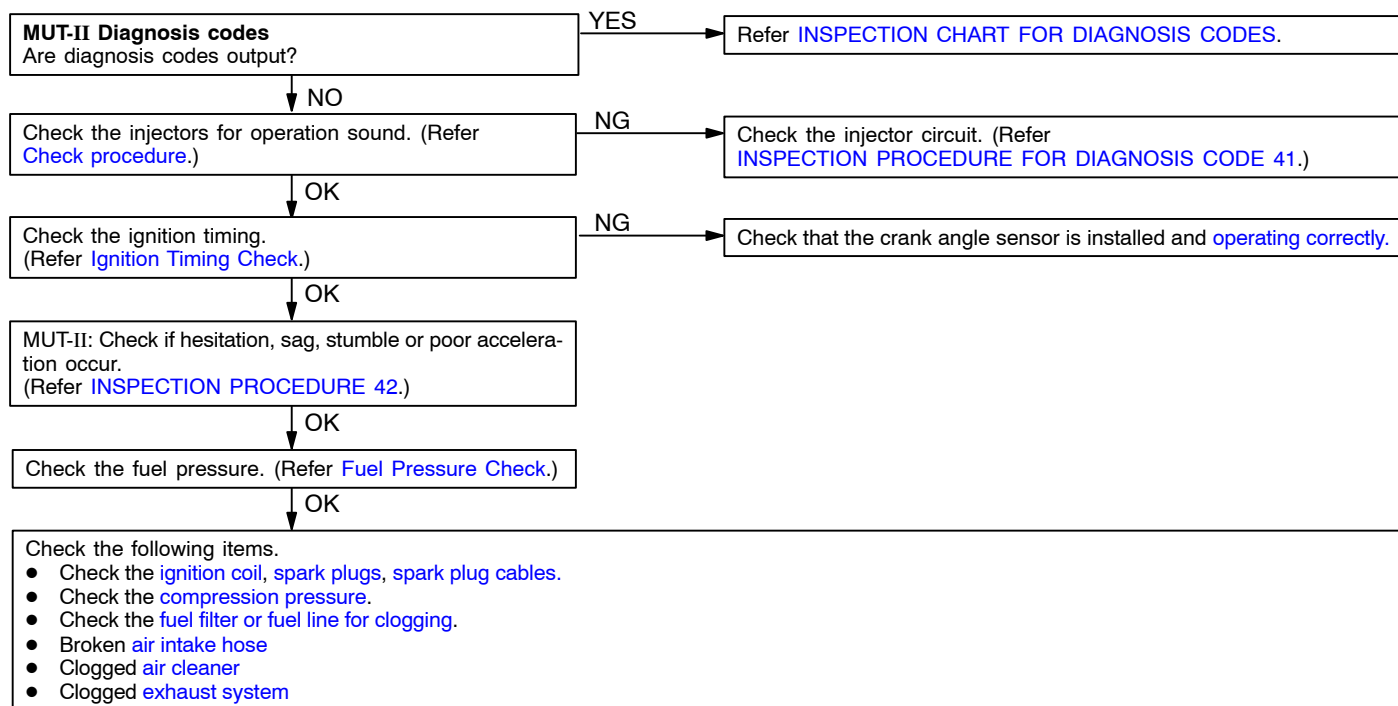
INSPECTION PROCEDURE 17

Deceleration shock	Probable cause
Malfunction of the ISC system is suspected.	<ul style="list-style-type: none"> Malfunction of the ISC system



INSPECTION PROCEDURE 18

Poor acceleration	Probable cause
Defective ignition system, abnormal air-fuel ratio, poor compression pressure, etc. are suspected.	<ul style="list-style-type: none"> Malfunction of the ignition system Malfunction of air-fuel ratio control system Malfunction of the fuel supply system Poor compression Clogged exhaust system



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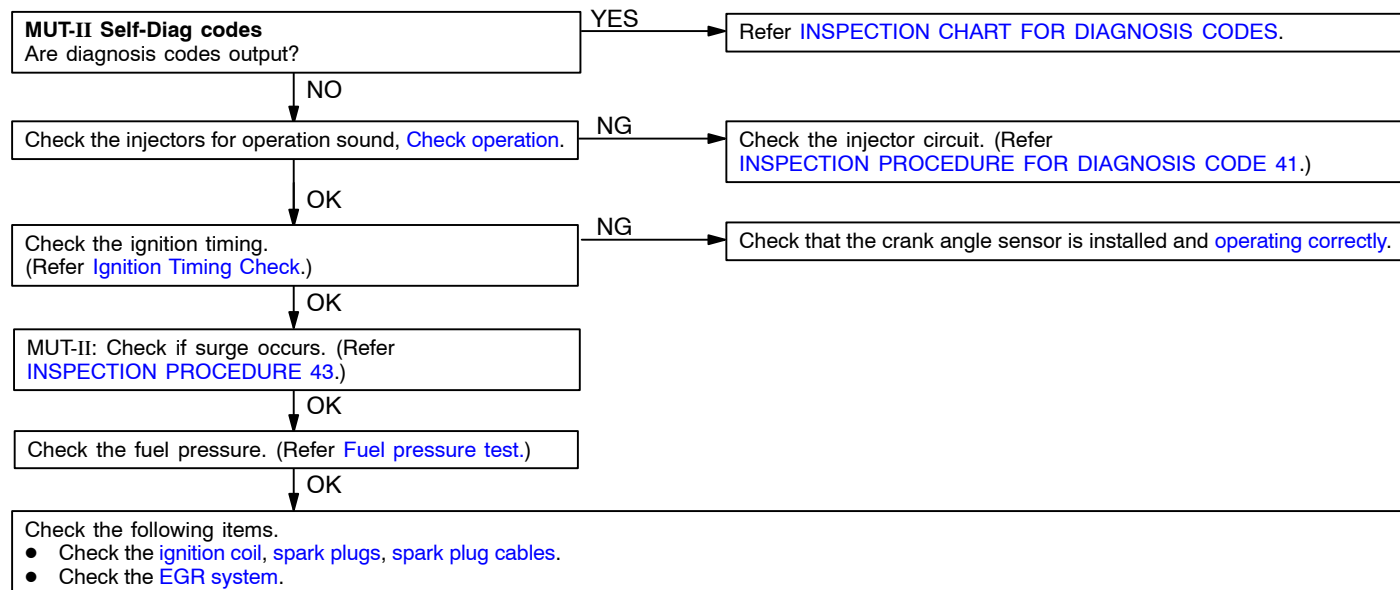
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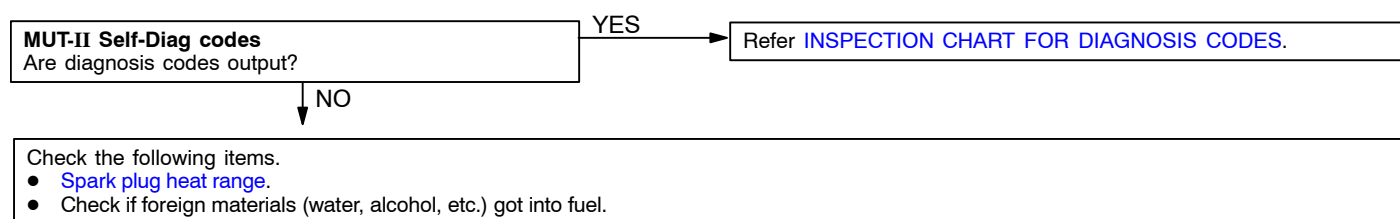
INSPECTION PROCEDURE 19

Surge	Probable cause
Defective ignition system, abnormal air-fuel ratio, etc. are suspected.	<ul style="list-style-type: none"> Malfunction of the ignition system Malfunction of air-fuel ratio control system Malfunction of the EGR solenoid system



INSPECTION PROCEDURE 20

Knocking	Probable cause
In cases such as the above, the cause is probably that the heat value of the spark plug is inappropriate.	<ul style="list-style-type: none"> Defective knock sensor Inappropriate heat value of the spark plug



INSPECTION PROCEDURE 21

Dieseling	Probable cause
Fuel leakage from injectors is suspected.	<ul style="list-style-type: none"> Fuel leakage from injectors

Check the injectors for [fuel leakage](#).

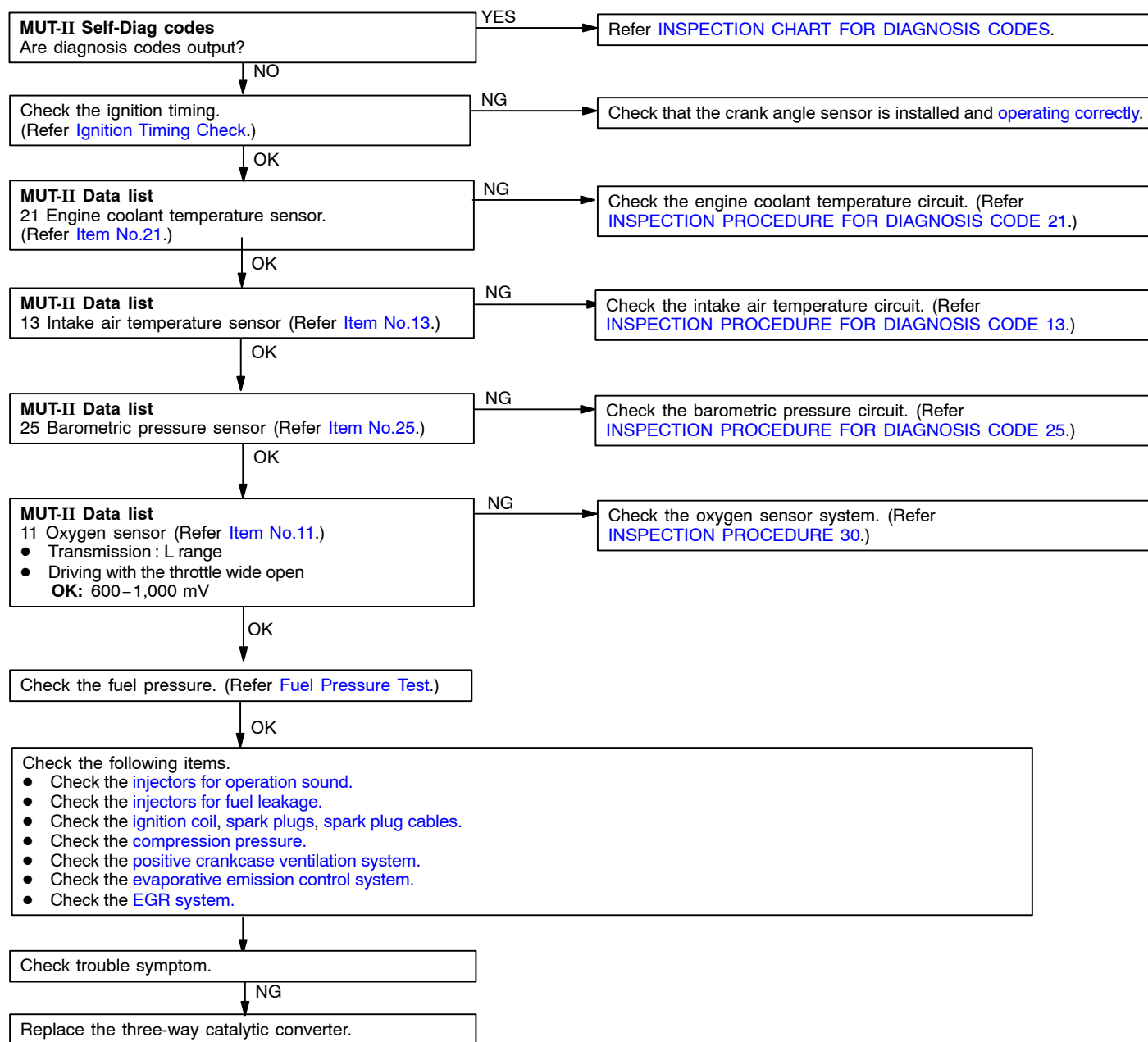
INSPECTION PROCEDURE 22

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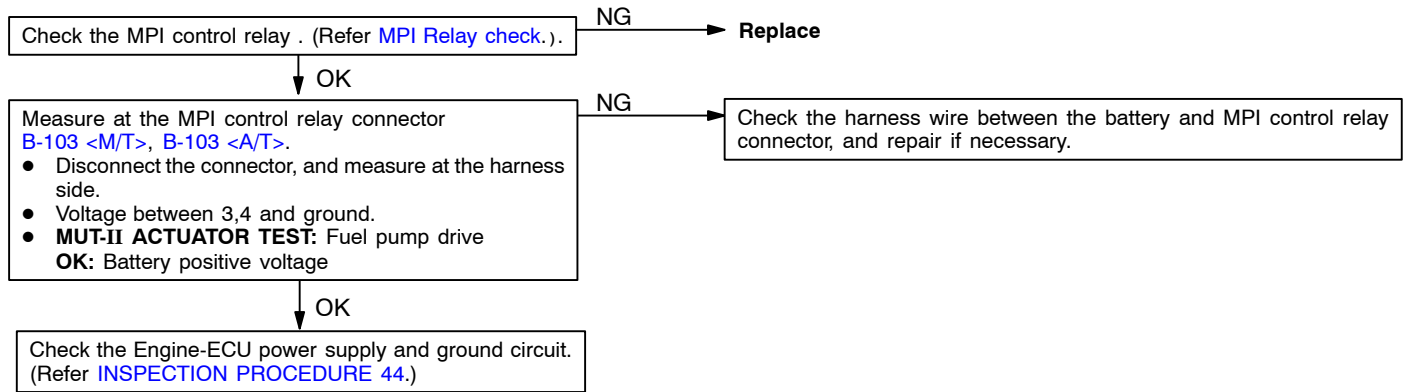
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Too high CO and HC concentration when idling	Probable cause
Abnormal air-fuel ratio is suspected.	<ul style="list-style-type: none"> Malfunction of the air-fuel ratio control system. Deteriorated catalyst



INSPECTION PROCEDURE 23

Power supply system and ignition switch–IG system	Probable cause
When an ignition switch ON signal is input to the Engine-ECU, the Engine-ECU turns the MPI control relay ON. This causes battery positive voltage to be supplied to the Engine-ECU, injectors and air flow sensor.	<ul style="list-style-type: none"> • Malfunction of the ignition switch • Malfunction of the MPI control relay • Improper connector contact, open circuit or short-circuited harness wire • Malfunction of the Engine-ECU



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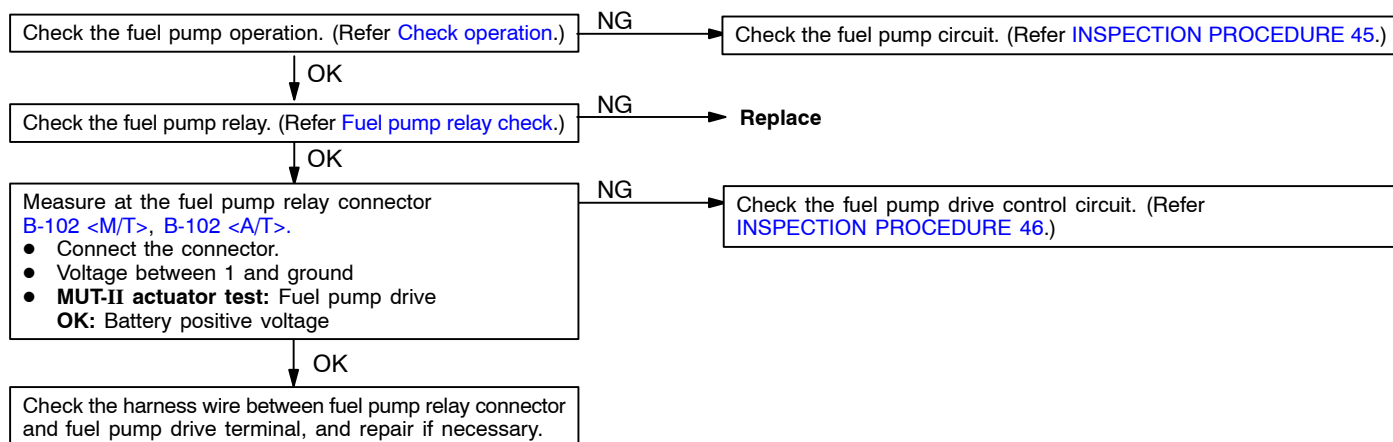
INSPECTION PROCEDURE 24

Fuel pump system	Probable cause
The Engine-ECU turns the fuel pump relay ON when the engine is cranking or running, and this supplies power to drive the fuel pump.	<ul style="list-style-type: none"> Malfunction of the fuel pump relay Malfunction of the fuel pump Improper connector contact, open circuit or short-circuited harness wire Malfunction of the Engine-ECU

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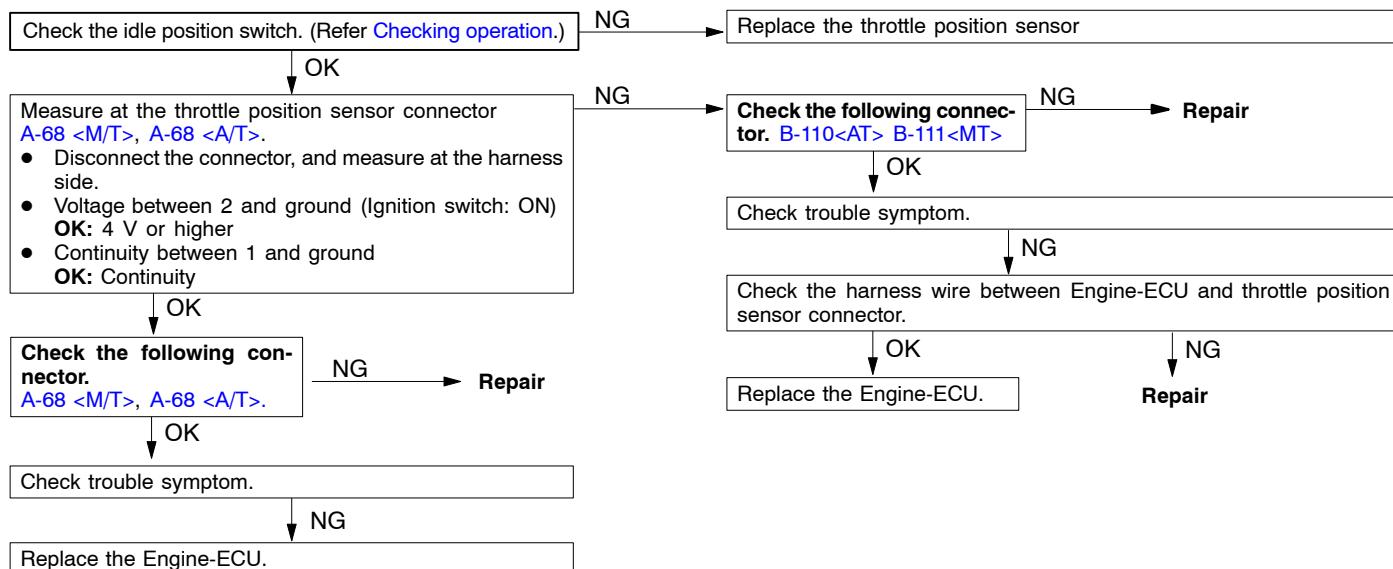
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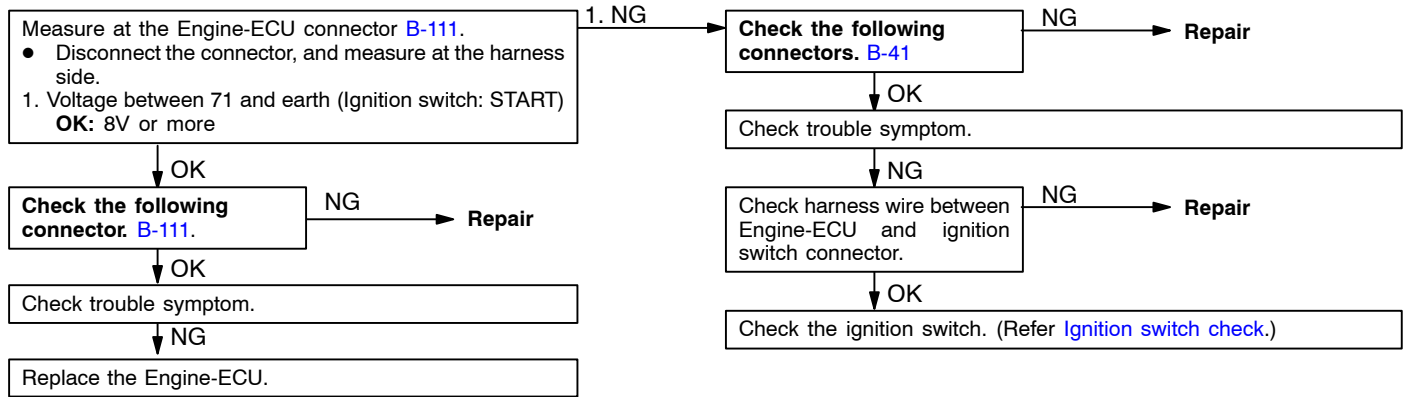
INSPECTION PROCEDURE 25

Idle position switch system	Probable cause
The idle position switch inputs the condition of the accelerator pedal, i.e. whether it is depressed or released (HIGH/LOW), to the Engine-ECU. The Engine-ECU controls the ISC servo based on this input.	<ul style="list-style-type: none"> Maladjustment of the accelerator pedal Maladjustment of the fixed SAS Maladjustment of the idle position switch and throttle position sensor Improper connector contact, open circuit or short-circuited harness wire Malfunction of the Engine-ECU



INSPECTION PROCEDURE 26

Ignition switch-ST system <M/T>	Probable cause
The ignition switch-ST inputs a HIGH signal to the engine-ECU while the engine is cranking. The Engine-ECU controls the fuel injection, etc. during starting based on this input.	<ul style="list-style-type: none"> Malfunction of ignition switch Improper connector contact, open circuit or short-circuited harness wire Malfunction of the Engine-ECU.



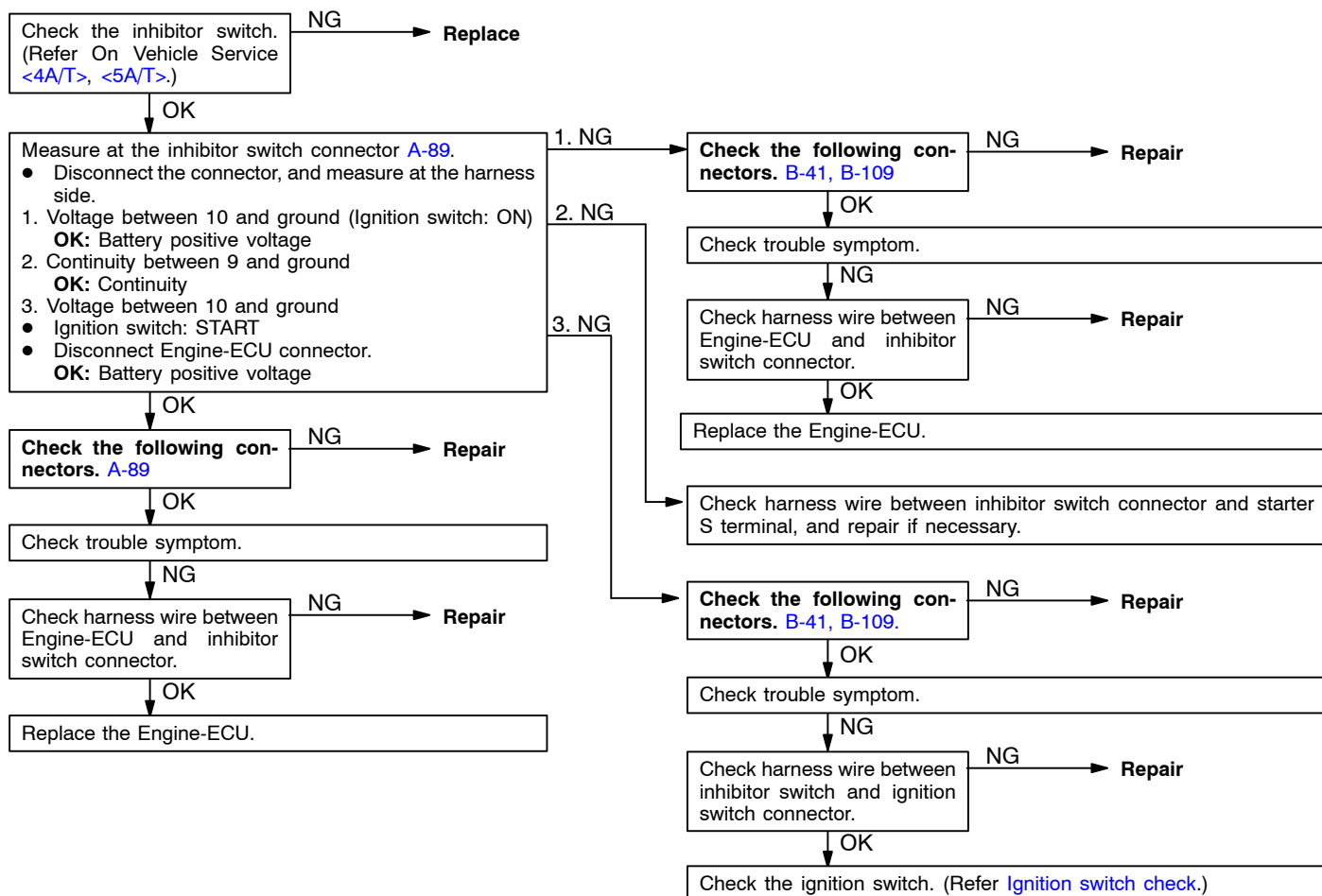
INSPECTION PROCEDURE 27

Ignition switch-ST and inhibitor switch system <A/T>	Probable cause
<ul style="list-style-type: none"> The ignition switch – ST inputs a HIGH signal to the Engine-ECU while the engine is cranking. The Engine-ECU controls fuel injection, etc. during starting based on this input. The inhibitor switch inputs the condition of the select lever, i.e. whether it is in P or N range or in some other range, to the Engine-ECU. The Engine-ECU controls the ISC servo based on this input. 	<ul style="list-style-type: none"> Malfunction of ignition switch Malfunction of inhibitor switch Improper connector contact, open circuit or short circuited harness wire Malfunction of the Engine-ECU.

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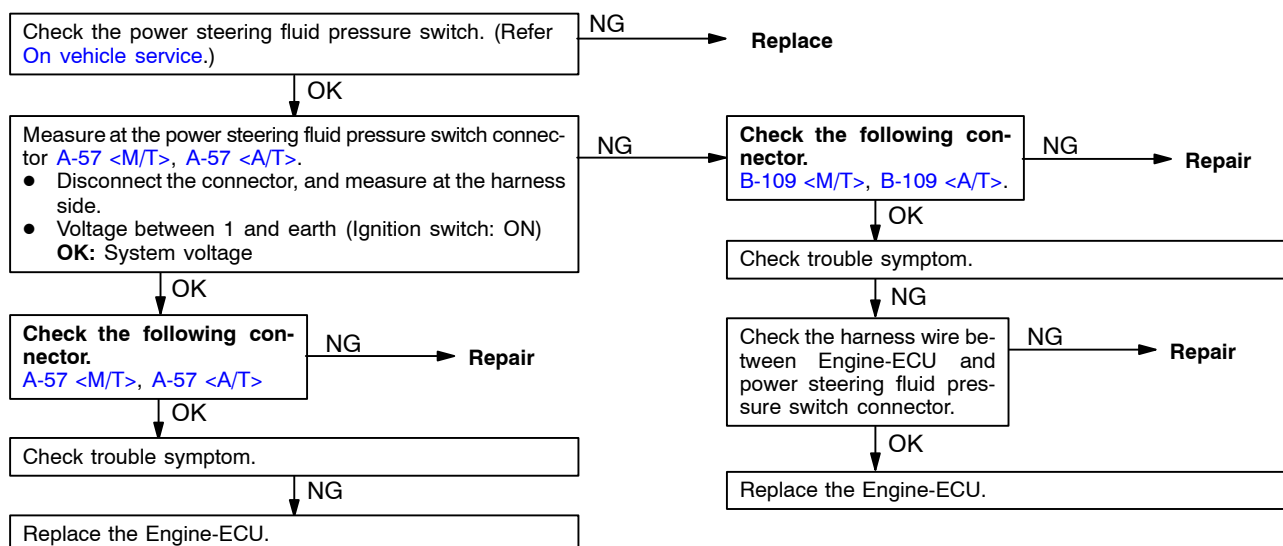
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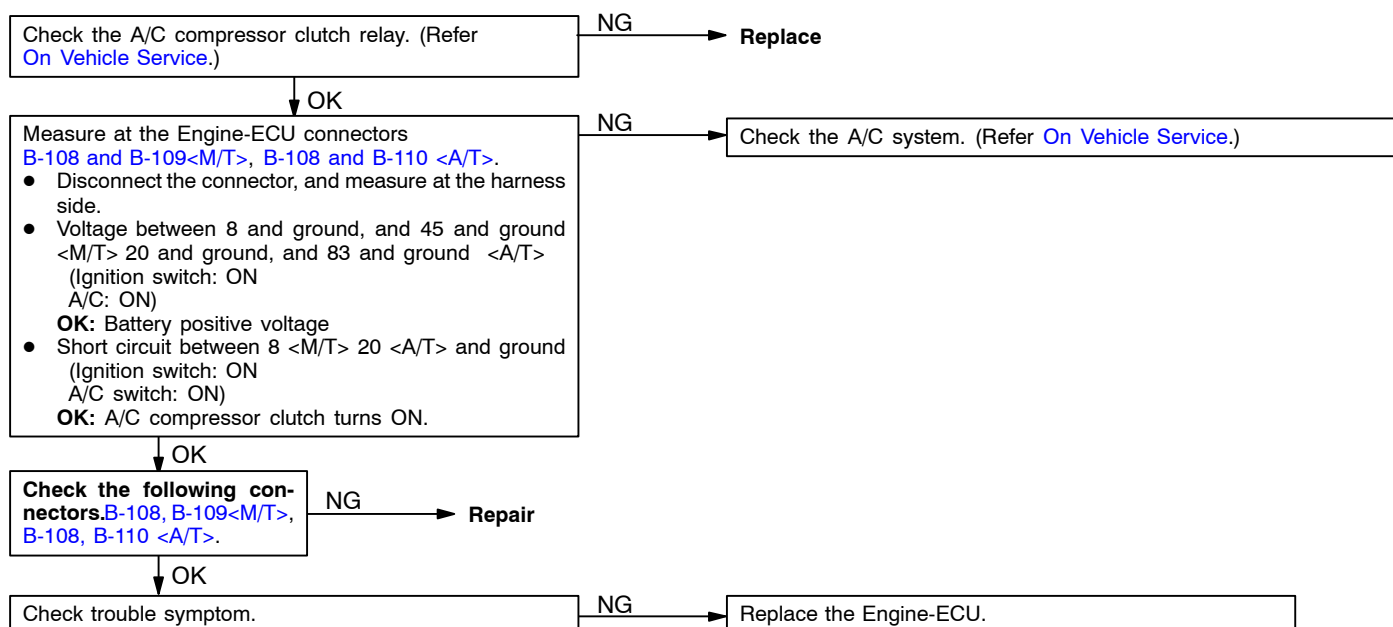
INSPECTION PROCEDURE 28

Power steering fluid pressure switch system	Probable cause
The presence or absence of power steering load is input to the Engine-ECU. The Engine-ECU controls the idle speed control (ISC) servo based on this input.	<ul style="list-style-type: none"> Malfunction of power steering fluid pressure switch Improper connector contact, open circuit or short circuited harness wire Malfunction of Engine-ECU



INSPECTION PROCEDURE 29

A/C switch and A/C relay system	Probable cause
When an A/C ON signal is input to the Engine-ECU, the Engine-ECU carries out control of the ISC servo, and also operates the A/C compressor magnetic clutch.	<ul style="list-style-type: none"> Malfunction of A/C control system Malfunction of A/C switch Improper connector contact, open circuit or short circuited harness wire Malfunction of Engine-ECU



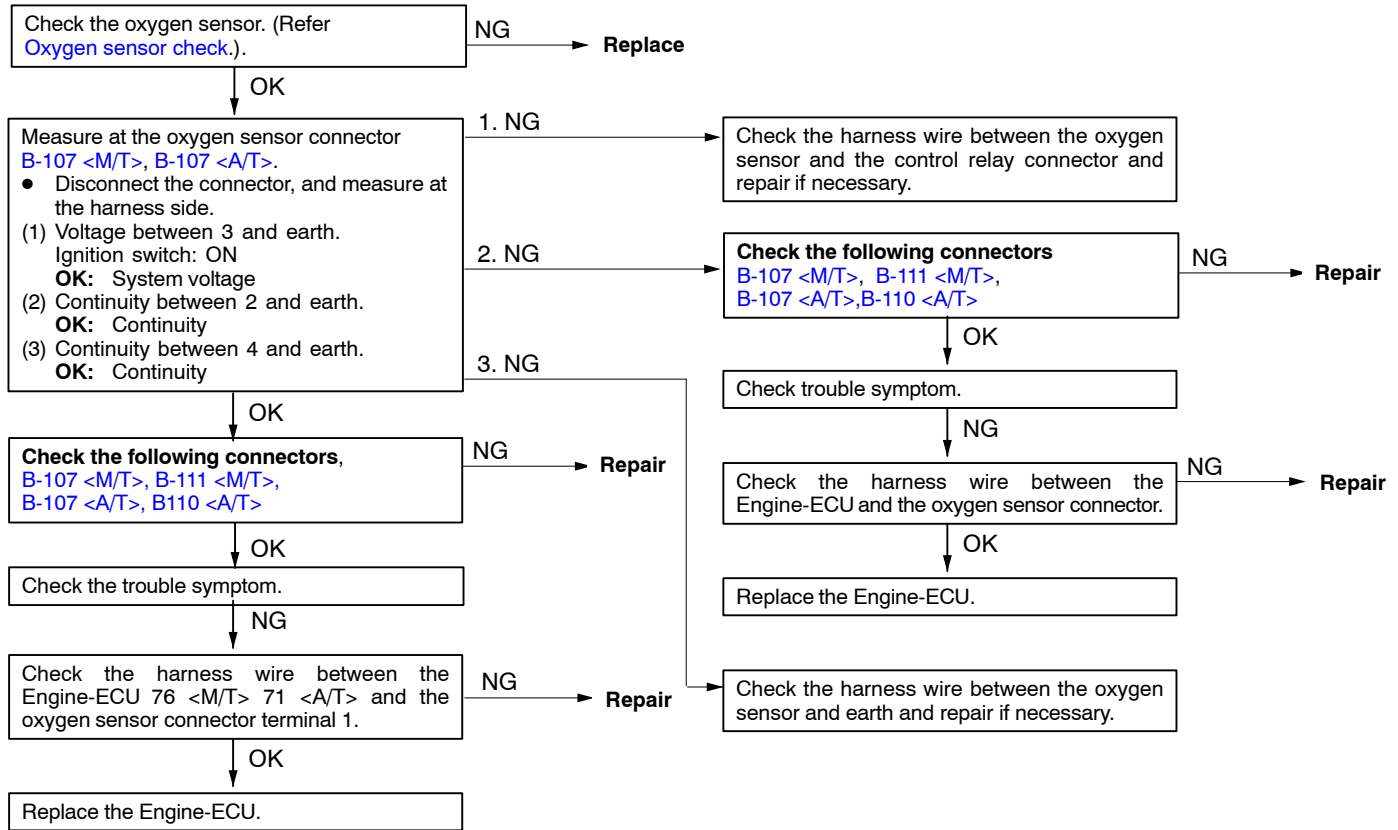
INSPECTION PROCEDURE 30

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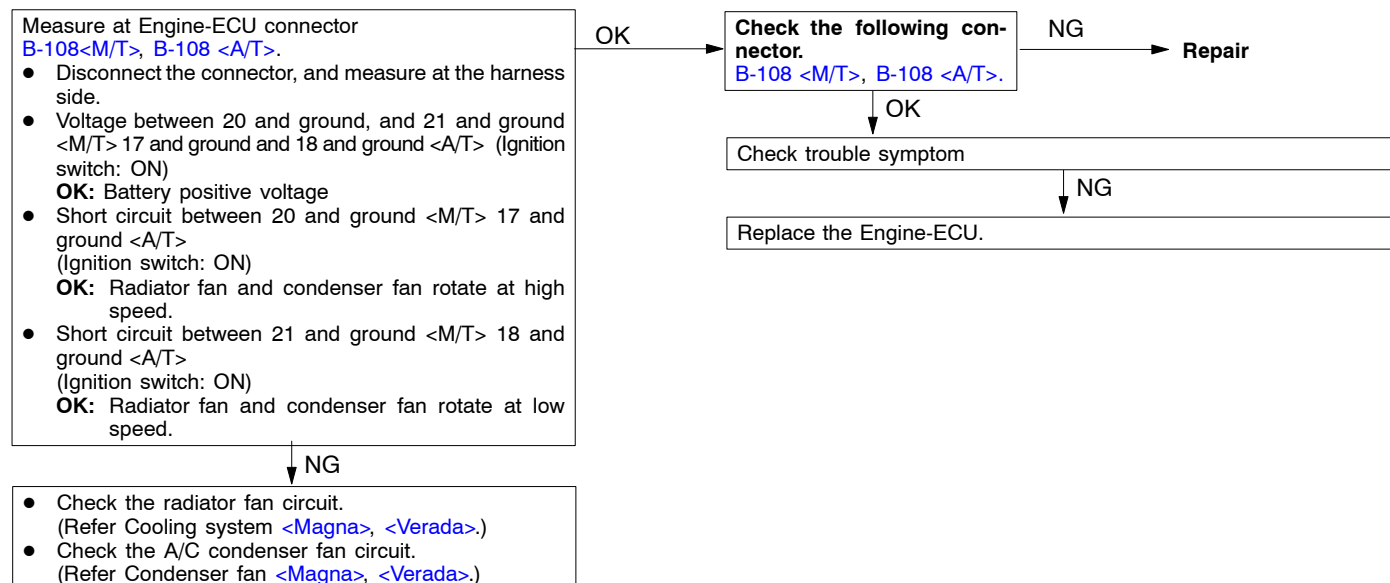
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Oxygen sensor system	Probable cause
<ul style="list-style-type: none"> The oxygen sensor detects the oxygen content in exhaust gas, converts it to voltage and sends the voltage to the engine ECU. The engine ECU controls the fuel injection amount to adjust the air/fuel ratio to theoretical one. 	<ul style="list-style-type: none"> Malfunction of the oxygen sensor Improper connector contact, open circuit or short-circuited harness wire Malfunction of the Engine-ECU



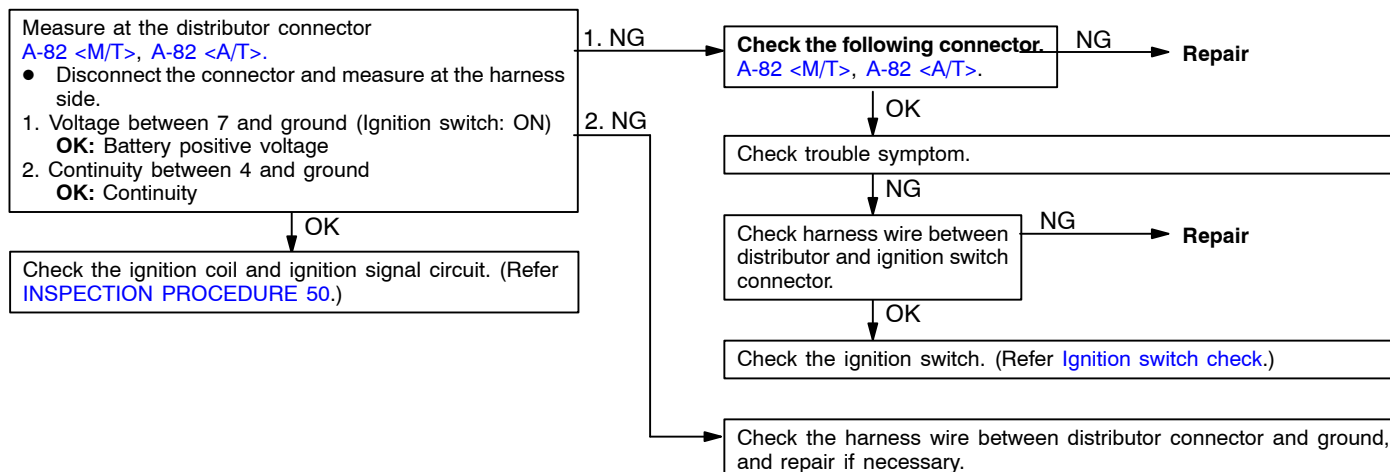
INSPECTION PROCEDURE 31

Fan motor relay system (Radiator fan, A/C condenser fan)	Probable cause
The fan motor relay is controlled by the power transistor inside the Engine-ECU turning ON and OFF.	<ul style="list-style-type: none"> Malfunction of fan motor relay Malfunction of fan motor Improper connector contact, open circuit or short circuited harness wire Malfunction of the Engine-ECU



INSPECTION PROCEDURE 32

Ignition circuit system	Probable cause
The Engine-ECU interrupts the ignition coil primary current by turning the ignition power transistor inside the Engine-ECU ON and OFF.	<ul style="list-style-type: none"> Malfunction of ignition coil Malfunction of ignition power transistor unit Improper connector contact, open circuit or short circuited harness wire Malfunction of the Engine-ECU



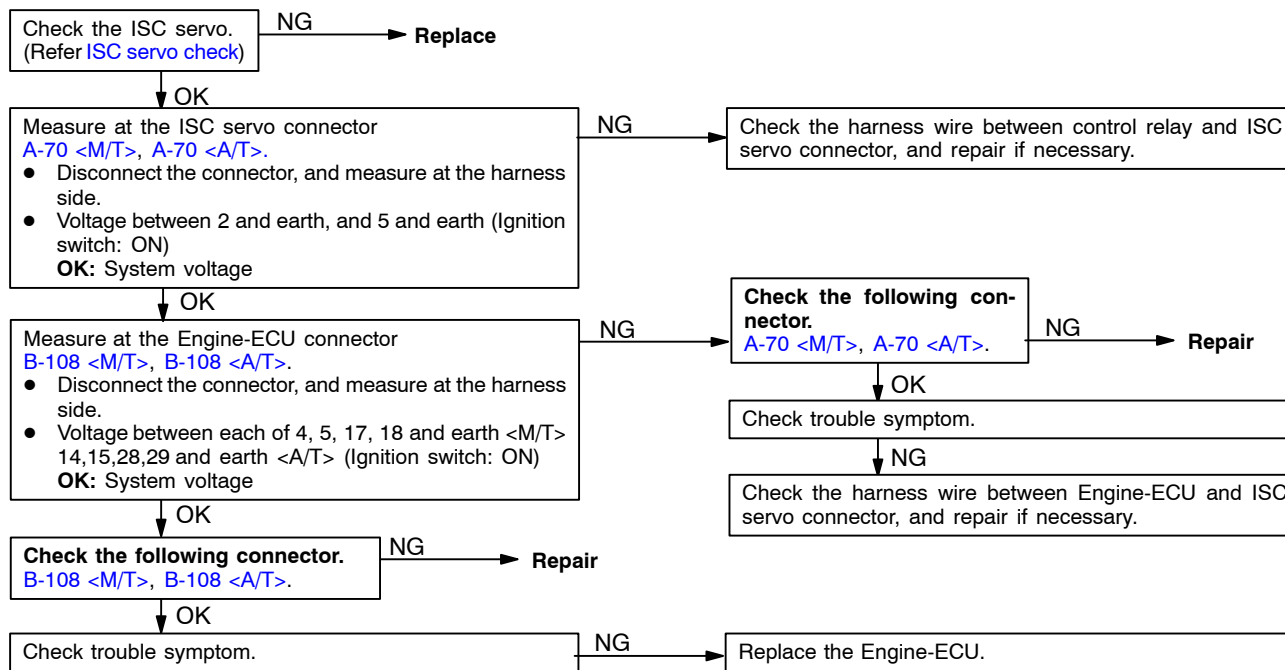
INSPECTION PROCEDURE 33

Idle speed control (ISC) servo (Stepper motor) system	Probable cause
The Engine-ECU controls the intake air volume during idling by opening and closing the servo valve located in the bypass air passage.	<ul style="list-style-type: none"> Malfunction of ISC servo Improper connector contact, open circuit or short circuited harness wire Malfunction of the Engine-ECU

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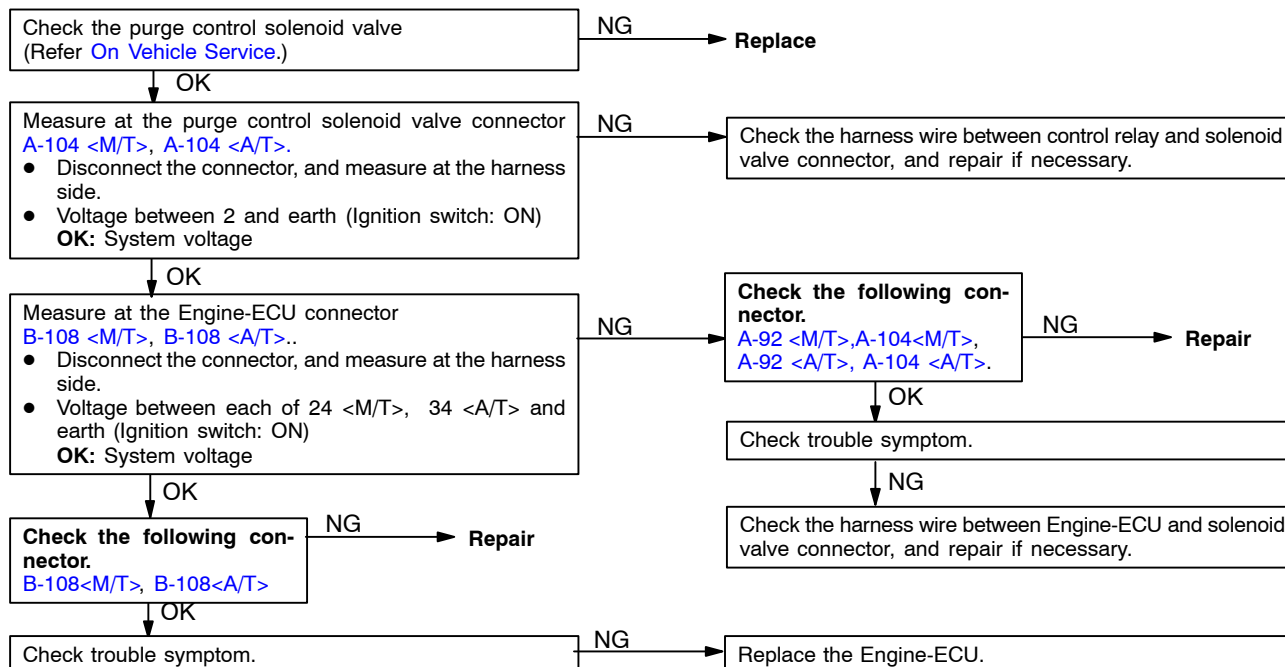
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INSPECTION PROCEDURE 34

Purge control solenoid valve system	Probable cause
The purge control solenoid valve controls the purging of air from the canister located inside the intake manifold.	<ul style="list-style-type: none"> Malfunction of solenoid valve Improper connector contact, open circuit or short circuited harness wire Malfunction of the Engine-ECU



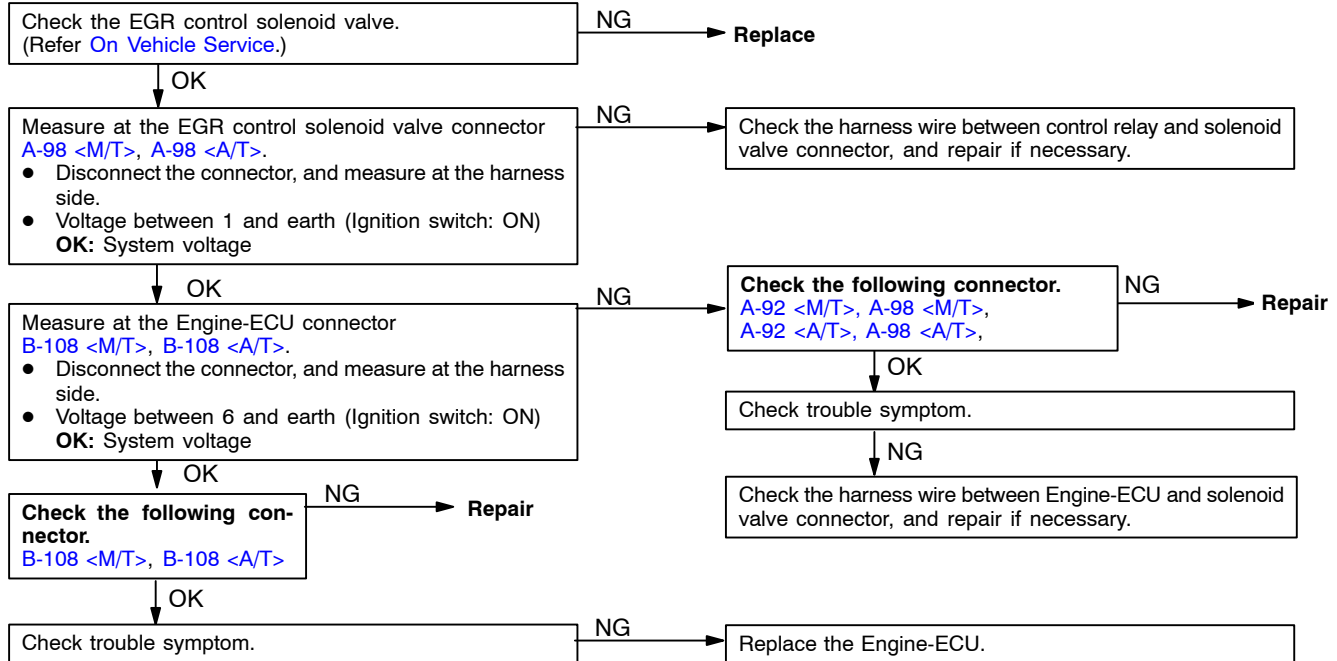
INSPECTION PROCEDURE 35

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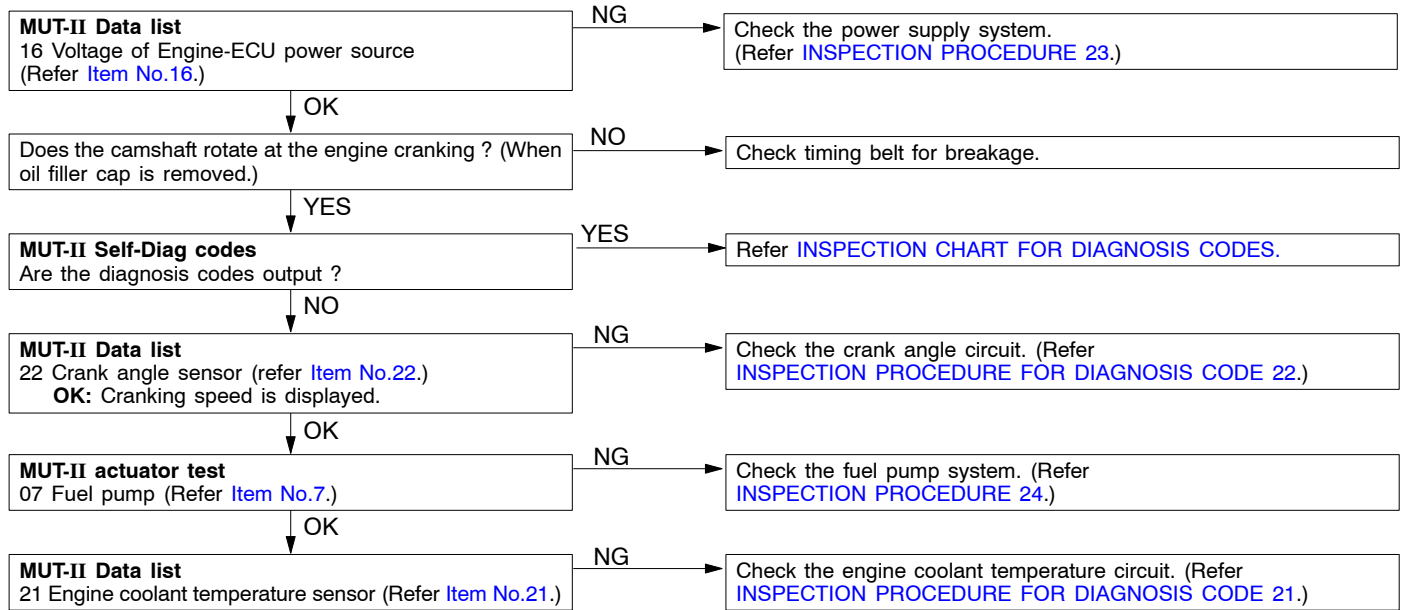
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EGR control solenoid valve system	Probable cause
The EGR control solenoid valve is controlled by the negative pressure resulting from EGR operation leaking to port "A" of the throttle body.	<ul style="list-style-type: none"> Malfunction of solenoid valve Improper connector contact, open circuit or short-circuited harness wire Malfunction of the Engine-ECU



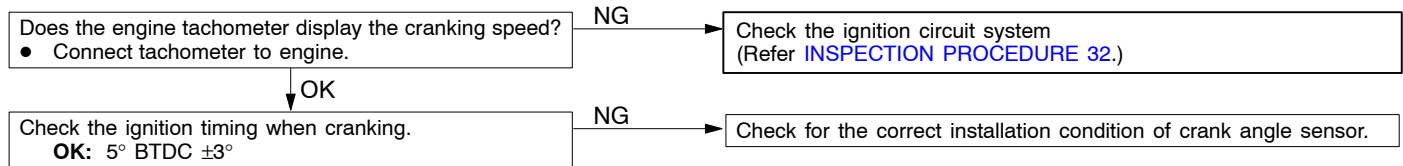
INSPECTION PROCEDURE 36

MUT-II: Inspection of no initial combustion



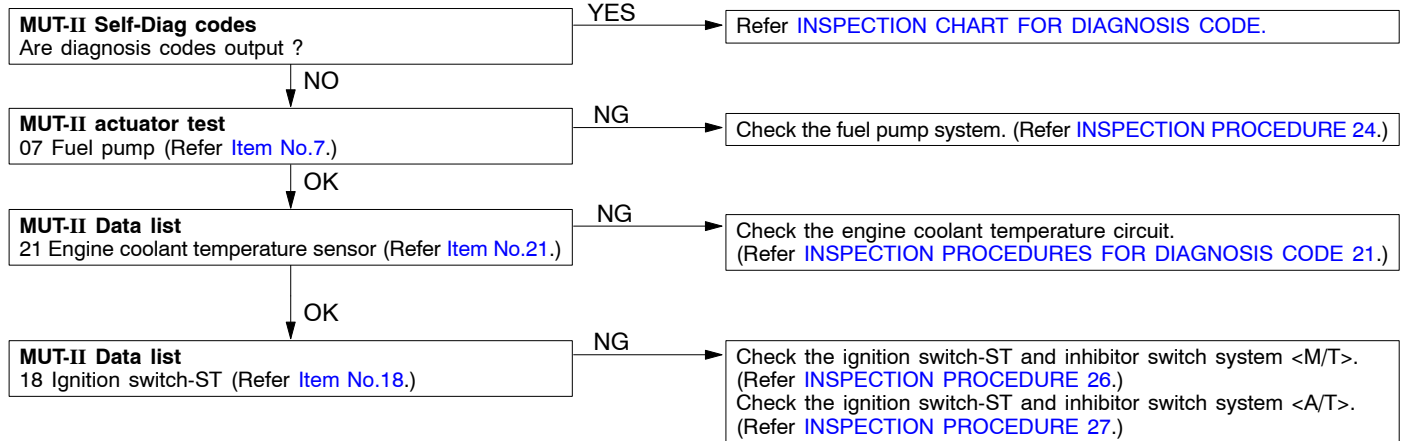
INSPECTION PROCEDURE 37

Ignition system: Inspection of no initial combustion



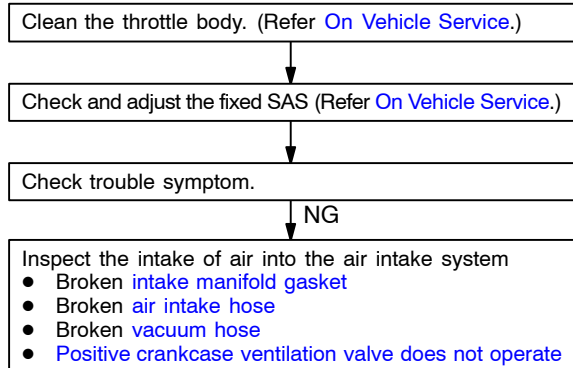
INSPECTION PROCEDURE 38

MUT-II: Check if incomplete combustion occurs.



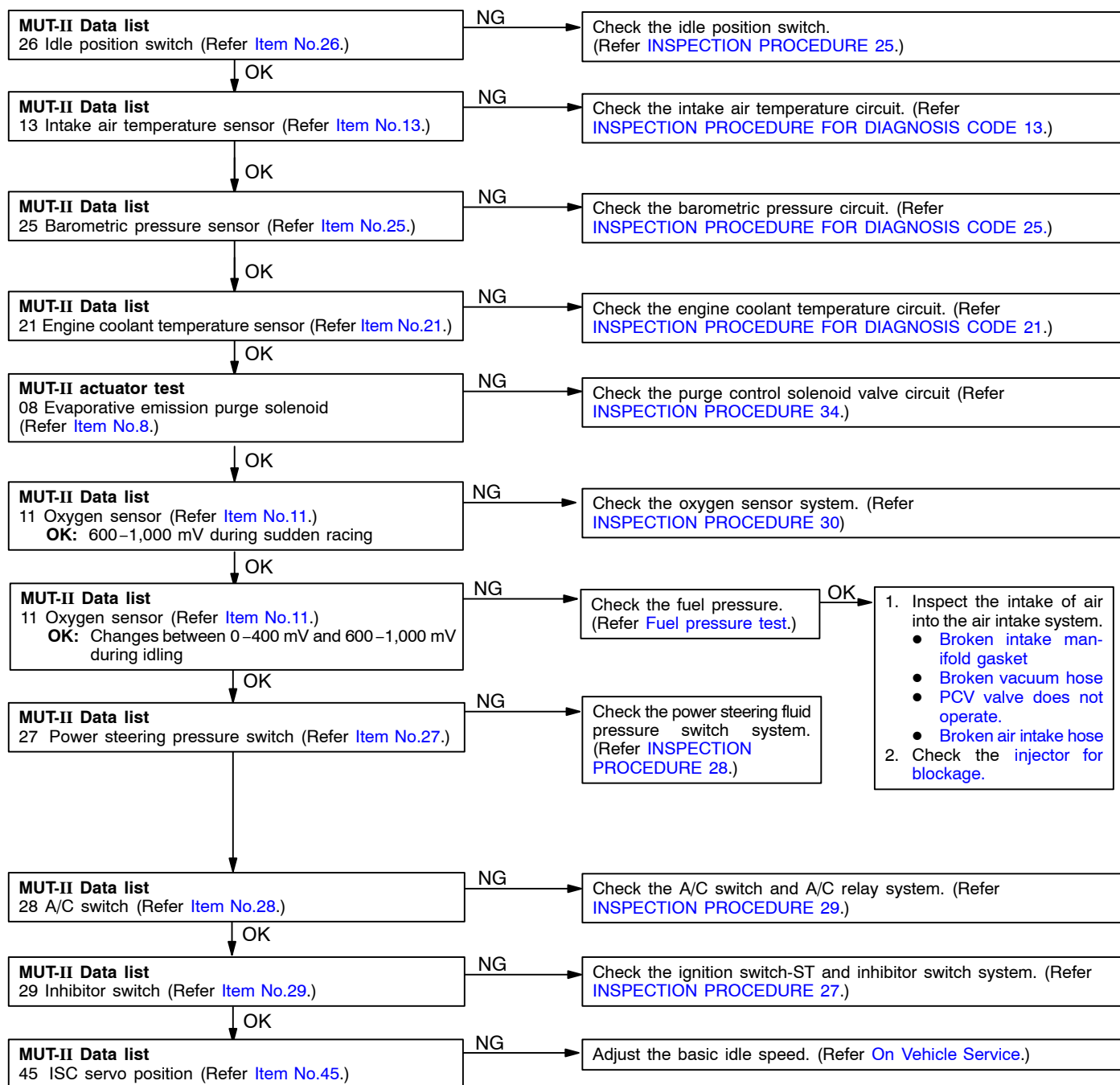
INSPECTION PROCEDURE 39

Check if hunting occurs.



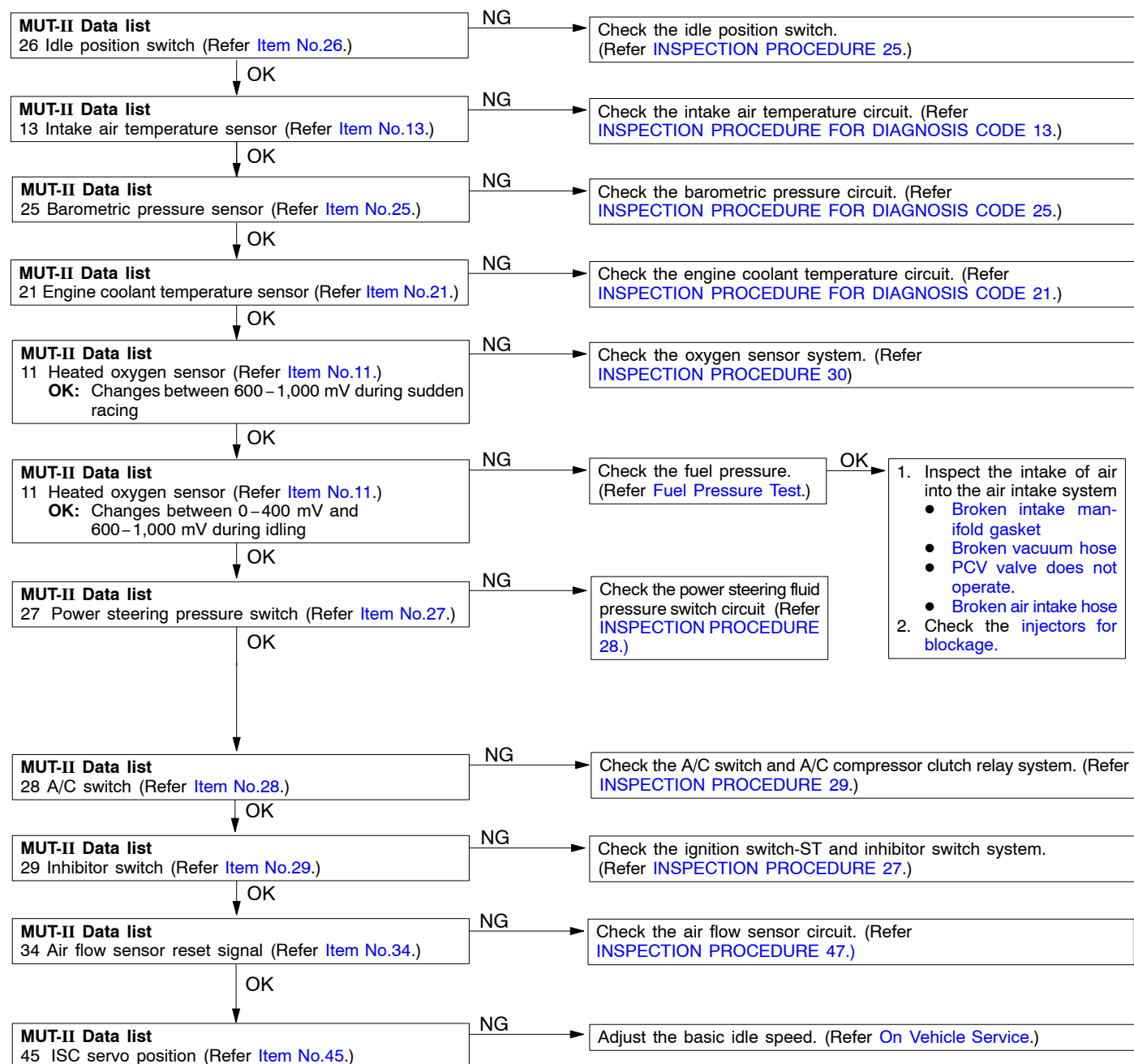
INSPECTION PROCEDURE 40

MUT-II: Check if idle speed is unstable.

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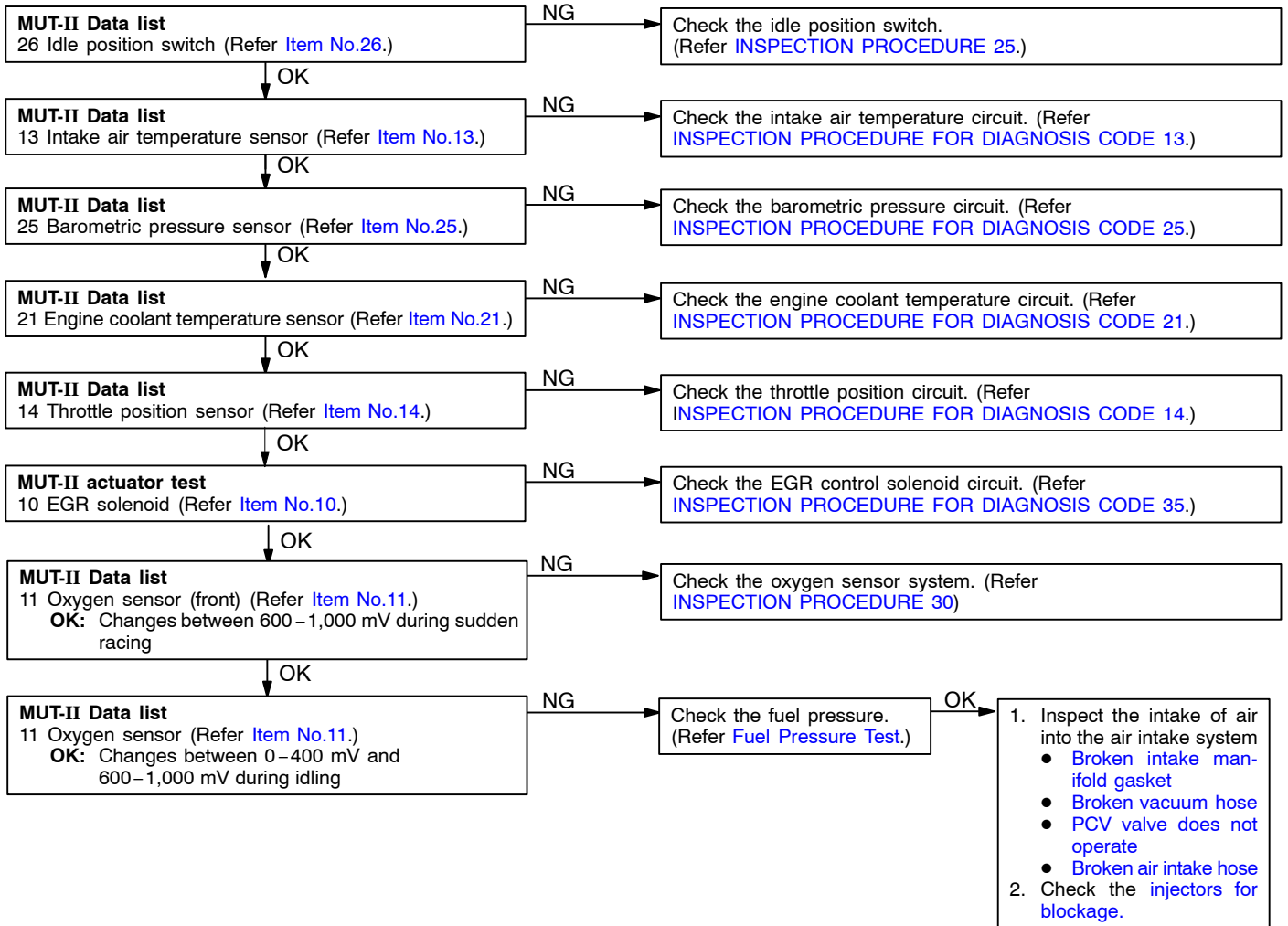
INSPECTION PROCEDURE 41

MUT-II: Engine stalling inspection when the engine is warm and idling.



INSPECTION PROCEDURE 42

MUT-II: Check if hesitation, sag, stumble or poor acceleration occurs.



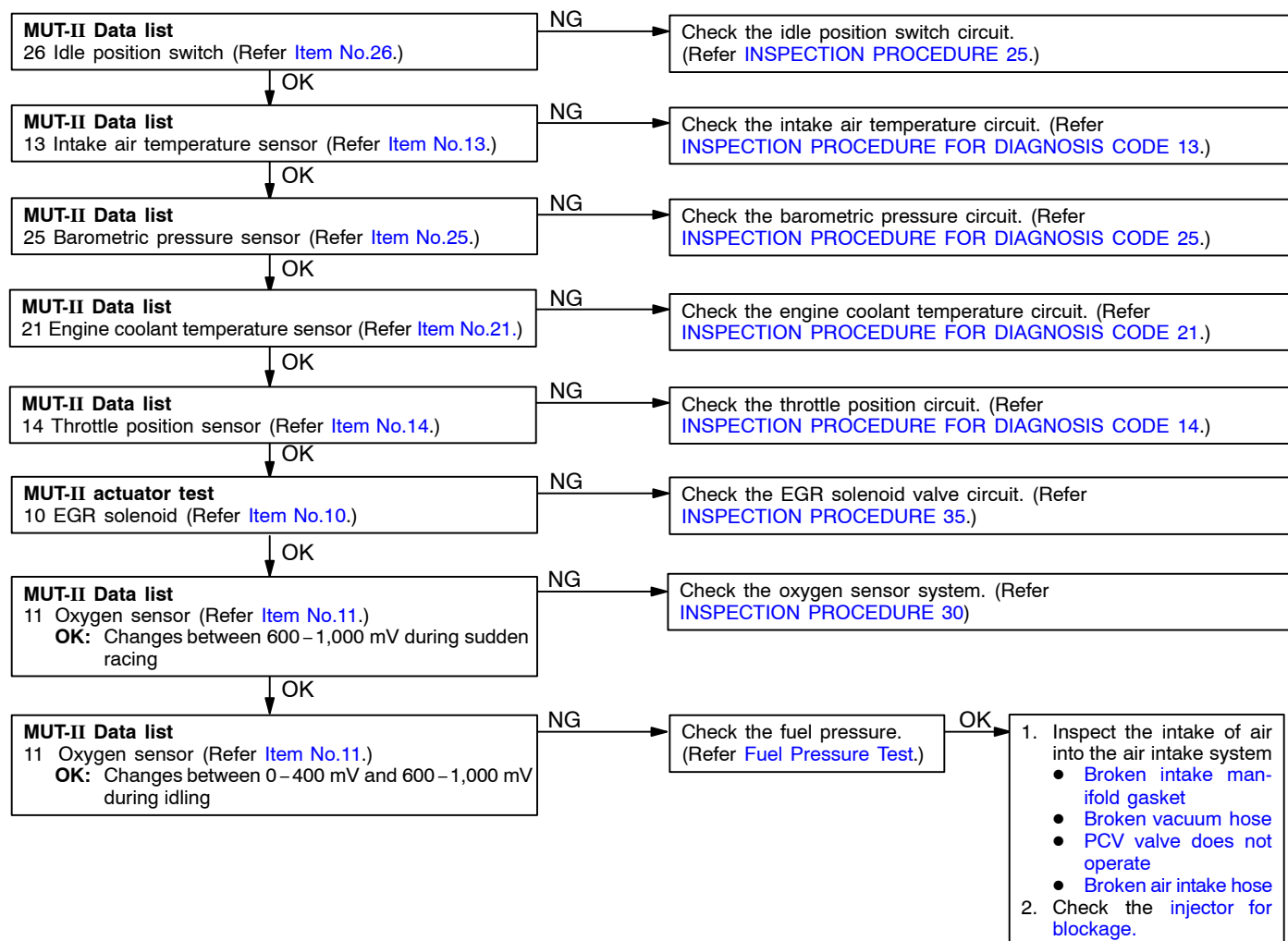
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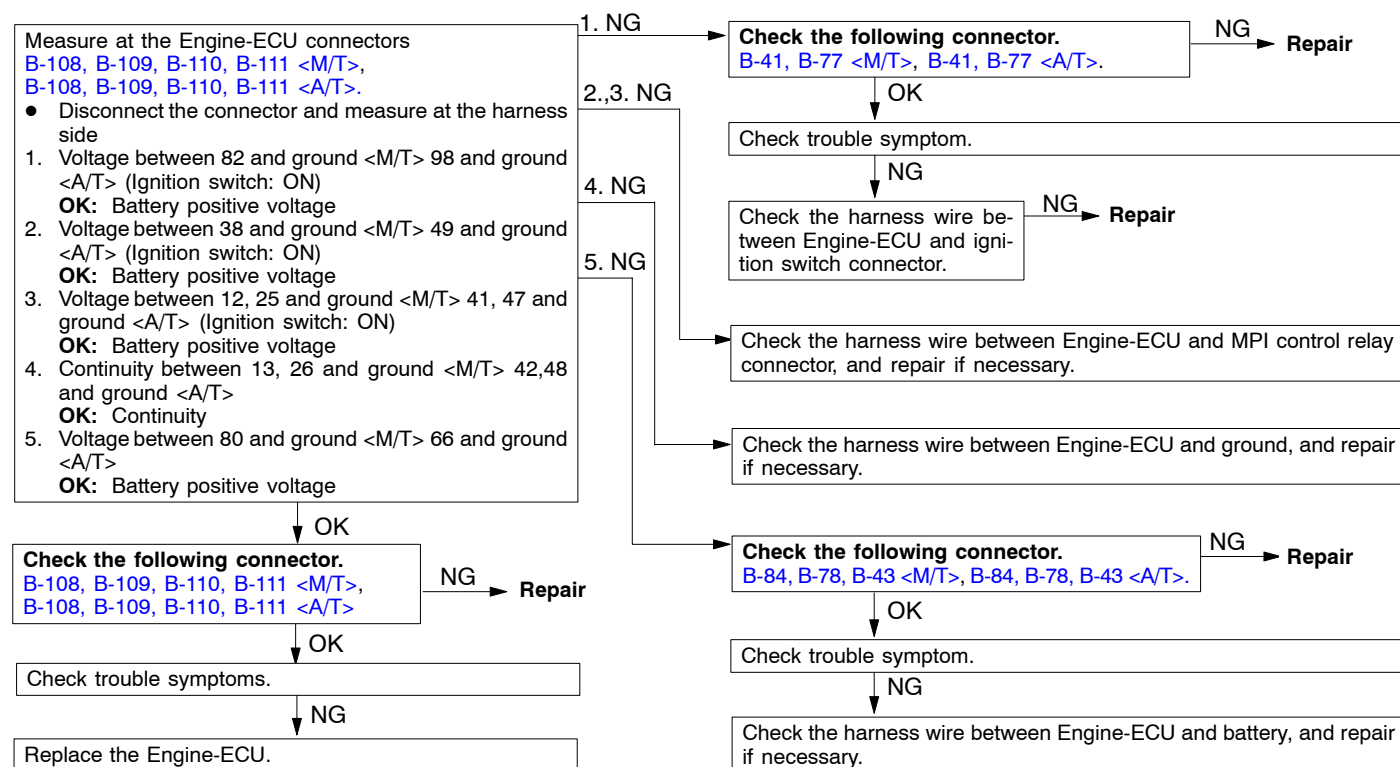
INSPECTION PROCEDURE 43

MUT-II: Check if surge occurs.

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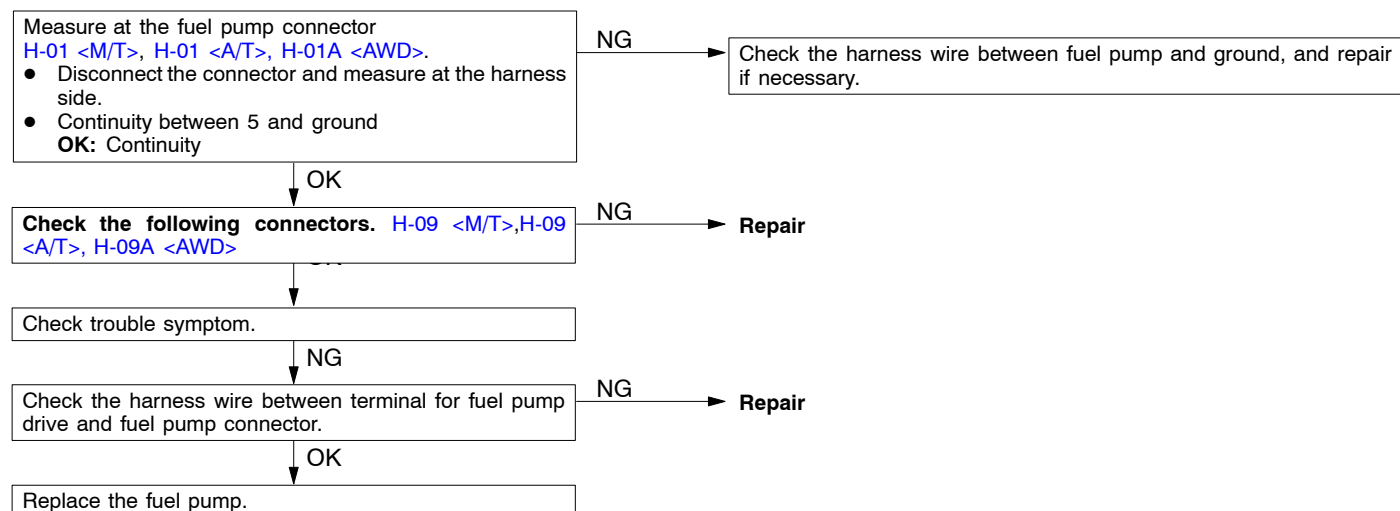
INSPECTION PROCEDURE 44

Check the Engine-ECU power supply and ground circuit.



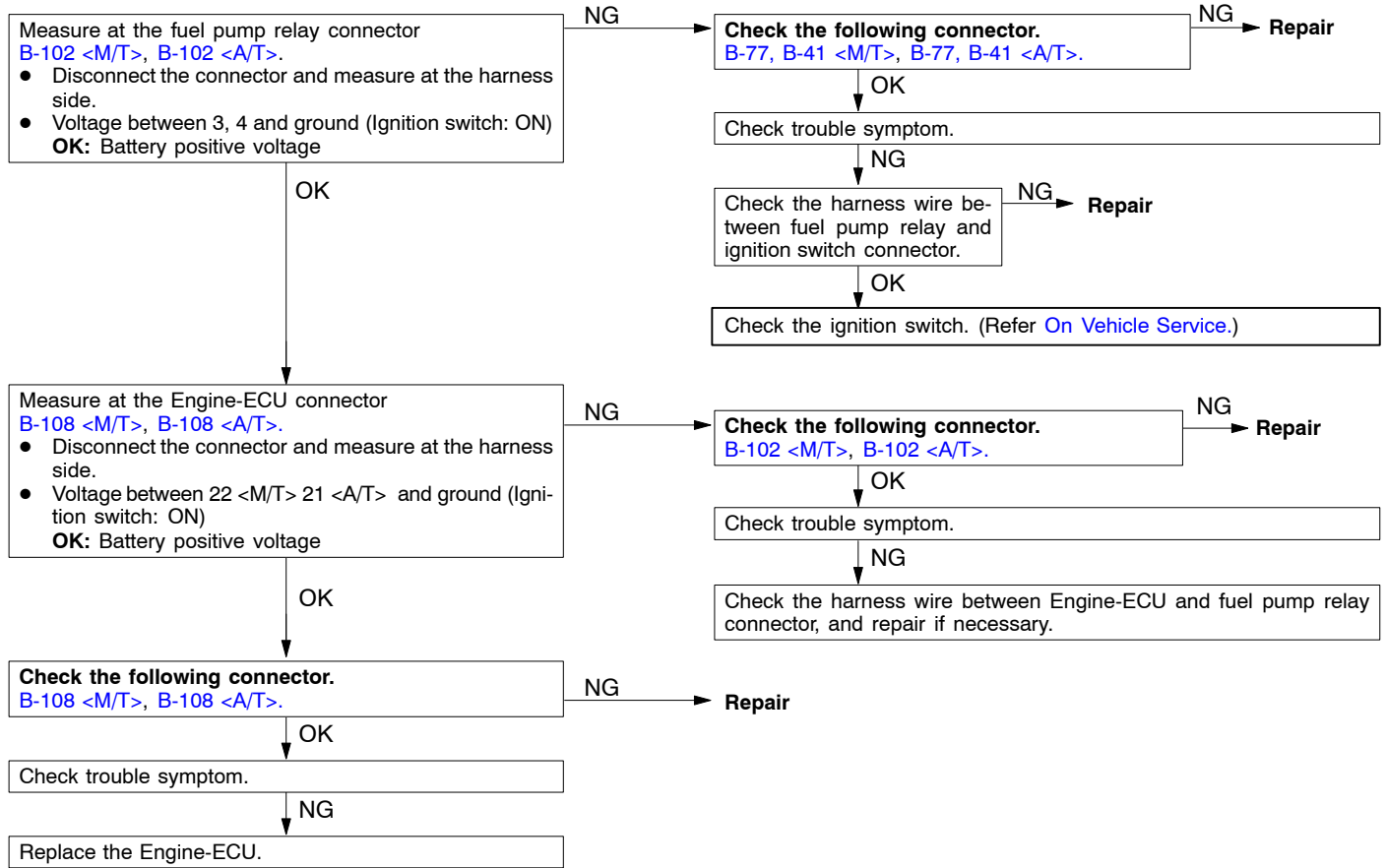
INSPECTION PROCEDURE 45

Check fuel pump circuit.



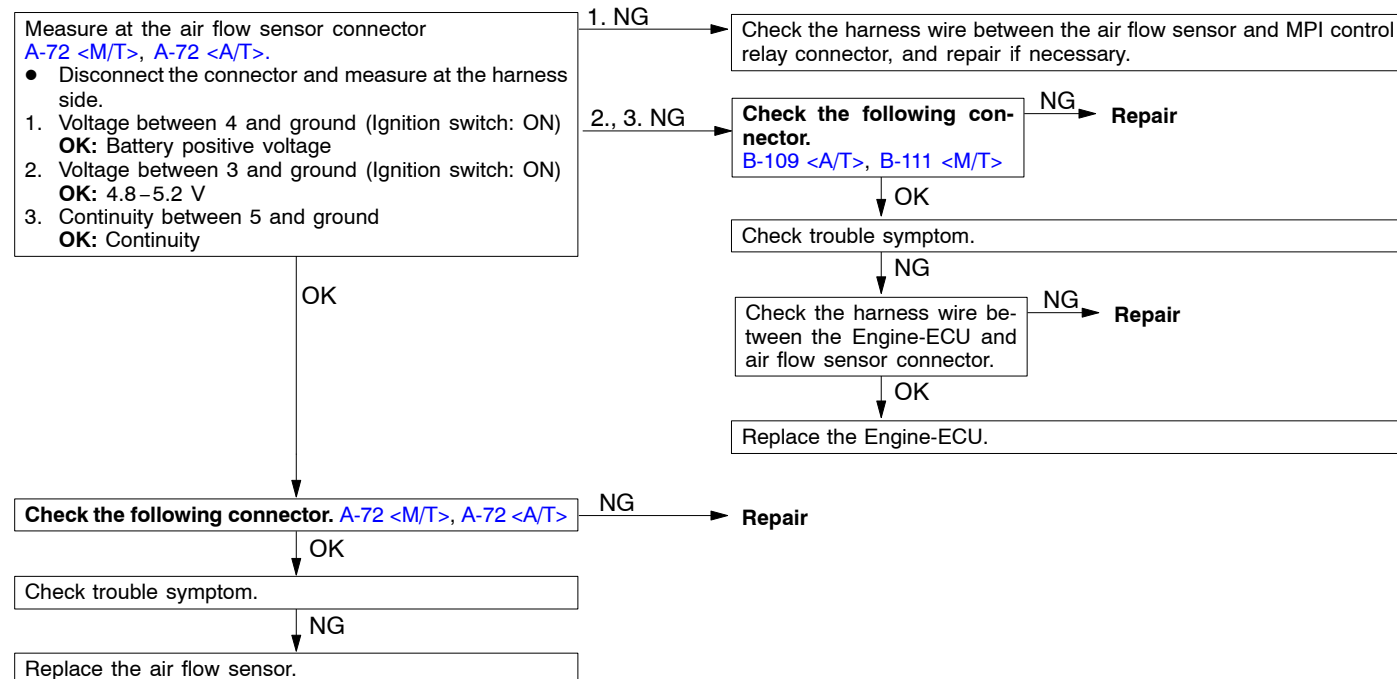
INSPECTION PROCEDURE 46

Check the fuel pump drive control circuit.



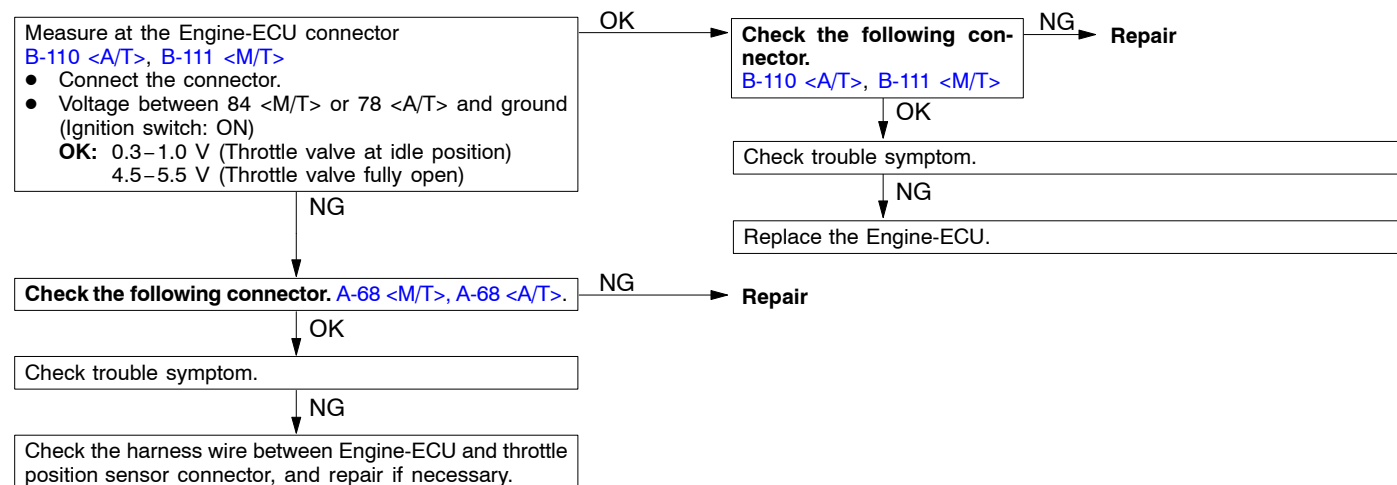
INSPECTION PROCEDURE 47

Check air flow sensor control circuit.



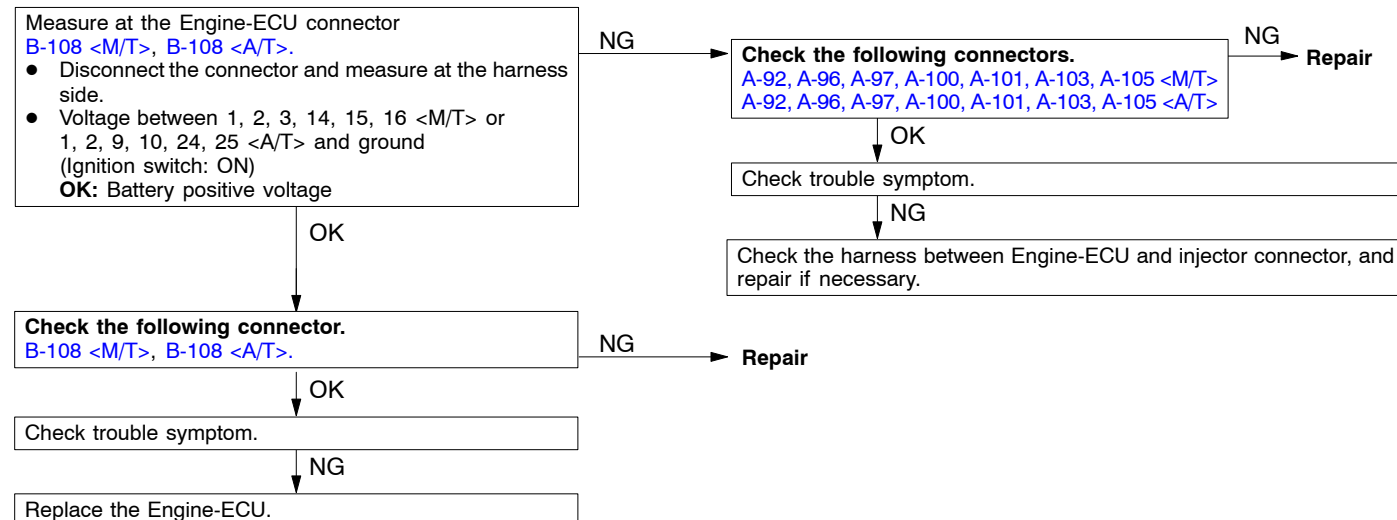
INSPECTION PROCEDURE 48

Check throttle position sensor (TPS) output circuit.



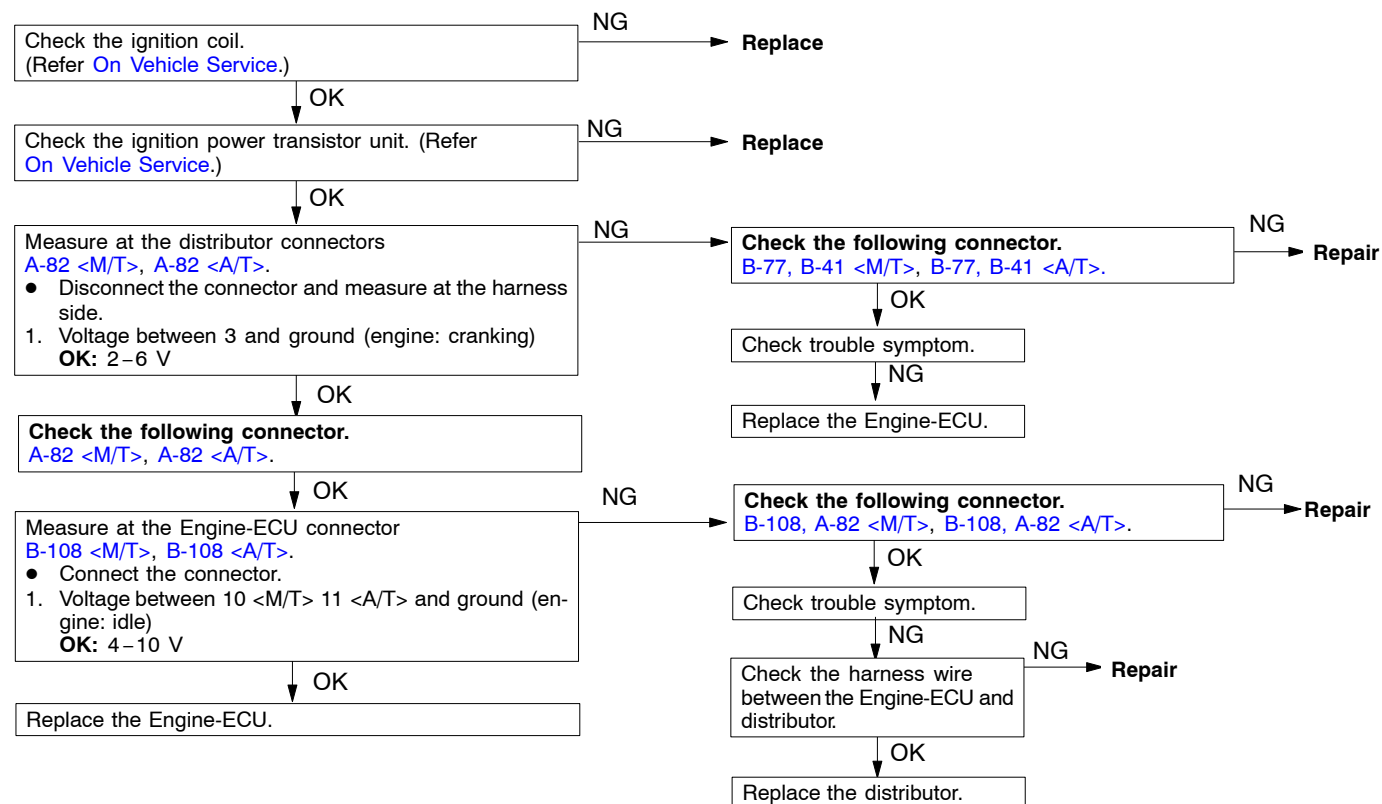
INSPECTION PROCEDURE 49

Check injector control circuit



INSPECTION PROCEDURE 50

Check ignition signal circuit.


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DATA LIST REFERENCE TABLE

Caution

1. When shifting the select lever to D range, the brakes should be applied so that the vehicle does not move forward.
2. Driving tests always need another personnel.
- *1: In a new vehicle [driven approximately 500 km or less], the air flow sensor output frequency is sometimes 10% higher than the standard frequency.
- *2: After performing a warm up idle from an initial engine temperature of -20°C , if the idle speed is lower than the standard value then it is assumed that the air volume limiter in the throttle body is defective (even if the ISC motor is fully open).
- *3: The injector drive time represents the time when the cranking speed is at 250 rpm or below when the power supply voltage is 11 V.
- *4: In a new vehicle [driven approximately 500 km or less], the injector drive time is sometimes 10% longer than the standard time.
- *5: The idle position switch normally turns off when the voltage of the throttle position sensor is 50 – 100mV higher than the voltage at the idle position. If the closed throttle position switch turns back on after the throttle position sensor voltage has risen by 100mV and the throttle valve has opened, the closed throttle position switch and the throttle position sensor need to be adjusted.
- *6: In a new vehicle [driven approximately 500 km or less], the step of the stepper motor is sometimes 3 steps greater than the standard value.

Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.
11	Oxygen sensor	Engine: Warm (Air/fuel mixture is made leaner when decelerating, and is made richer when racing.)	When at 4,000 r/min, engine is suddenly decelerated	200 mV or less	Procedure No. 30
			When engine is suddenly raced	600–1,000 mV	
		Engine: Warm (The oxygen sensor signal is used to check the air/fuel mixture ratio, and control condition is also checked by the Engine-ECU.)	Engine is idling	400 mV or less ↔ 600–1,000 mV (Changes)	
			2,500 r/min		
12	Air flow sensor	<ul style="list-style-type: none"> Engine coolant temperature: $80-95^{\circ}\text{C}$ Lights, electric cooling fan and all accessories: OFF Transmission: Neutral (A/T: P range) 	Engine is idling	18–44 Hz	Code No. 12
			2,500 r/min	43–83 Hz	
			Engine is raced	Frequency increases in response to racing	
13	Intake air temperature sensor	Ignition switch: ON or with engine running	When intake air temperature is -20°C	-20°C	Code No. 13
			When intake air temperature is 0°C	0°C	
			When intake air temperature is 20°C	20°C	
			When intake air temperature is 40°C	40°C	
			When intake air temperature is 80°C	80°C	

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Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.
14	Throttle position sensor	Ignition switch: ON	Set to idle position	300–1,000 mV (6–20%)	Code No. 14
			Gradually open	Increases in proportion to throttle opening angle	
			Open fully	4,500–5,500 mV (80–100%)	
16	Power supply voltage	Ignition switch: ON		Battery positive voltage	Procedure No. 23
18	Cranking signal (ignition switch-ST)	Ignition switch: ON	Engine: Stopped	OFF	Procedure No.26 <M/T> Procedure No. 27 <A/T>
			Engine: Cranking	ON	
21	Engine coolant temperature sensor	Ignition switch: ON or with engine running	When engine coolant temperature is –20°C	–20°C	Code No. 21
			When engine coolant temperature is 0°C	0°C	
			When engine coolant temperature is 20°C	20°C	
			When engine coolant temperature is 40°C	40°C	
			When engine coolant temperature is 80°C	80°C	
22	Crank angle sensor *2	<ul style="list-style-type: none"> Engine: Cranking Tachometer: Connected 	Compare the rpm of the tachometer with the one of the MUT-II.	Identical	Code No. 22
		<ul style="list-style-type: none"> Engine: Idling Idle position switch: ON 	When engine coolant temperature is –20°C	1300–1500 r/min	
			When engine coolant temperature is 0°C	1300–1500 r/min	
			When engine coolant temperature is 20°C	1300–1500 r/min	
			When engine coolant temperature is 40°C	1050–1250 r/min	
			When engine coolant temperature is 80°C	600–800 r/min	
24	Vehicle speed sensor	Drive at 40 km/h		Approx. 40 km/h	Code No. 24
25	Barometric pressure sensor	Ignition switch: ON	At altitude of 0 m	101 kPa	Code No. 25
			At altitude of 600m	95 kPa	
			At altitude of 1,200 m	88 kPa	
			At altitude of 1,800 m	81 kPa	
26	Idle position switch	Ignition switch: ON Check by operating accelerator pedal repeatedly	Throttle valve: Set to idle position	ON	Procedure No. 25
			Throttle valve: Slightly open	OFF*5	

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Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.
27	Power steering pressure switch	Engine: Idling	Steering wheel stationary	OFF	Procedure No. 28
			Steering wheel turning	ON	
28	A/C switch	Engine: Idling (When A/C switch is ON, A/C compressor should be operating.)	A/C switch: OFF	OFF	Procedure No. 29
			A/C switch: ON	ON	
29	Inhibitor switch <A/T>	Ignition switch: ON	P or N	P or N	Procedure No. 27
			D,3, 2, L or R	D,3, 2, L or R	
34	Air flow sensor reset signal	Engine: Warm	Engine is idling	ON	–
			2500 r/min	OFF	
36	Ignition timing adjustment mode.	Engine: Idling	Ignition timing adjustment terminal is earthed	ON	–
			Ignition timing adjustment terminal is disconnected from earth	OFF	
37	Volumetric efficiency	<ul style="list-style-type: none"> Engine coolant temperature: 80–95°C Lights, electric cooling fan and all accessories: OFF Transmission: P range 	Engine is idling	15–35 %	–
			2,500 r/min	15–35 %	
			When engine is suddenly raced	Volumetric efficiency increases in response to racing	
38	Crank angle sensor	<ul style="list-style-type: none"> Engine cranking (reading is possible at 2000 r/min or less) Tachometer: connected 		Engine speeds displayed on the MUT-II and tachometer are identical.	–
41, 47	Injectors *3	Engine: Cranking	When engine coolant temperature is 0°C	12–18 ms	–
			When engine coolant temperature is 20°C	30–44 ms	
			When engine coolant temperature is 80°C	8–12 ms	
	Injectors *4	<ul style="list-style-type: none"> Engine coolant temperature: 80–95°C Lights, electric cooling fan and all accessories: OFF Transmission: P range 	Engine is idling	2.2–3.4 ms	
			2,500 r/min	2.0–3.2 ms	
			When engine is suddenly raced	Increases	

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Item No.	Inspection item	Inspection contents		Normal condition	Inspection procedure No.
44	Ignition coils and ignition power transistors	<ul style="list-style-type: none"> Engine: After having warmed up Timing light is set. (The timing light is set in order to check actual ignition timing.) 	Engine is idling	2–18 °BTDC	–
			2,500 r/min	25–45 °BTDC	
45	ISC servo (stepper motor) position *6	<ul style="list-style-type: none"> Engine coolant temperature: 80 – 95°C Lights, electric cooling fan and all accessories: OFF Transmission: P range) Idle position switch: ON Engine: Idling (When A/C switch is ON, A/C compressor should be operating) 	A/C switch: OFF	Increases by 2–25 steps	–
			A/C switch: OFF → ON	Increases by 10–70 steps	
			<ul style="list-style-type: none"> A/C switch: OFF Select lever: N range → D range 	Increases by 5–50 steps	
49	A/C compressor clutch relay	Engine: After having warmed up Engine is idling	A/C switch: OFF	OFF (Compressor clutch is not operating)	Procedure No. 29
			A/C switch: ON	ON (Compressor clutch is operating)	

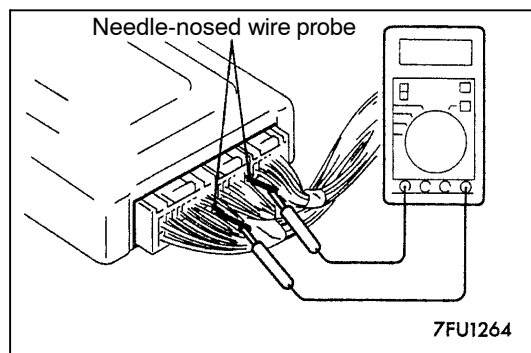
ACTUATOR TEST REFERENCE TABLE

Item No.	Inspection item	Drive contents	Inspection contents		Normal condition	Inspection procedure No.
01	Injectors	Cut fuel to No. 1 injector	Engine: Warm, idle (Cut the fuel supply to each injector in turn and check cylinders which don't affect idling.)		Idle speed drops equally for each injector	Code No. 41
02		Cut fuel to No. 2 injector				
03		Cut fuel to No. 3 injector				
04		Cut fuel to No. 4 injector				
05		Cut fuel to No. 5 injector				
06		Cut fuel to No. 6 injector				
07	Fuel pump	Fuel pump operates and fuel is recirculated.	<ul style="list-style-type: none"> Engine: Cranking Fuel pump: Activated <p>Inspect according to both the above conditions.</p>	<p>Pinch the return hose with fingers to feel the pulse of the fuel being recirculated.</p> <p>Listen near the fuel tank for the sound of fuel pump operation.</p>	<p>Pulse is felt.</p> <p>Typical electric fuel pump whine.</p>	Procedure No. 24
08	Purge control solenoid valve	Solenoid valve turns from OFF to ON.	Ignition switch: ON		Clicks when solenoid valve is driven.	Procedure No. 34
10	EGR control solenoid valve	Solenoid valve turns from OFF to ON.	Ignition switch: ON		Clicks when solenoid valve is driven.	Procedure No. 35
17	Basic ignition timing	Set to ignition timing adjustment mode	Engine: Idle Timing light is set		5° BTDC	–
20	Radiator fan (Hi) Condenser fan (Hi)	Drive the fan motors (radiator and condenser).	Ignition switch: ON A/C switch: ON		Fan motor operates at high speed.	Procedure No. 31
21	Radiator fan (Hi) Condenser fan (Low)	Drive the fan motors (radiator and condenser).	Ignition switch: ON A/C switch: ON		Fan motor operates at low speed.	Procedure No. 31
30	Basic idle speed	Set ISC servo to basic step	Engine idle speed		Stepper motor approx. 8 steps	–

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CHECK AT THE ENGINE A/T-ECU TERMINALS

TERMINAL VOLTAGE CHECK CHART

1. Connect a needle-nosed wire probe (paper clip etc.) to a voltmeter probe.
2. Insert the needle-nosed wire probe into each of the Engine A/T-ECU connector terminals from the wire side, and measure the voltage while referring to the check chart.

NOTE

1. Measure voltage with the Engine A/T-ECU connectors connected.
2. You may find it convenient to pull out the Engine A/T-ECU to make it easier to reach the connector terminals.
3. Checks don't have to be carried out in the order given in the chart.

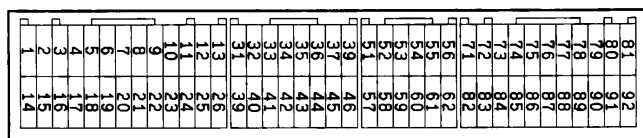
Caution

Short-circuiting the positive (+) probe between a connector terminal and ground could damage the vehicle wiring, the sensor, Engine A/T-ECU, or all three. Use care to prevent this!

3. If voltmeter shows any deviation from standard value, check the corresponding sensor, actuator and related electrical wiring, then repair or replace.
4. After repair or replacement, recheck with the voltmeter to confirm that the repair has corrected the problem.

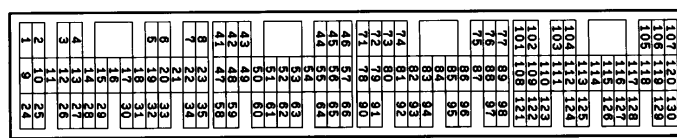
Engine A/T-ECU Connector Terminal Arrangement

<M/T>



9FU0393

<A/T>



03AG079N

Terminal No.		Check item	Check condition (Engine condition)	Normal condition
M/T	A/T			
1	1	No. 1 injector	While engine is idling after having warmed up, suddenly depress the accelerator pedal slightly	From 11-14 V momentarily drops
14	9	No. 2 injector		
2	24	No. 3 injector		
15	2	No. 4 injector		
3	10	No. 5 injector		
16	25	No. 6 injector		
4	14	Stepper motor coil<A1>	Engine: Soon after the warmed up engine is started	SV ↔ 0-3V (Changes repeatedly)
17	28	Stepper motor coil<A2>		
5	15	Stepper motor coil<B1>		
18	29	Stepper motor coil<B2>		
8	20	A/C relay	<ul style="list-style-type: none"> • Engine: Idle speed • A/C switch: OFF → ON (A/C compressor is operating) 	SV or momentarily 6V or more → 0.3 V

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Terminal No.		Check item	Check condition (Engine condition)		Normal condition
M/T	A/T				
10	11	Power transistor unit	Engine: 3000 rpm		0.3-3.0 V
12	41	Power supply	Ignition switch: ON		SV
25	47				
19	19	Volume air flow sensor reset signal	Engine: idle speed		0-1V
			Engine:3000 rpm		6-9V
20	17	Fan motor relay (High)	Radiator fan is not operating (Engine coolant temperature is 90°C or less)		SV
			Radiator fan is operating at high speed (Engine coolant temperature is 105°C or more)		0-3V
21	18	Fan motor relay (Low)	Radiator fan is not operating (Engine coolant temperature is 90°C or less)		SV
			Radiator fan is operating at low speed (Engine coolant temperature is 90-105°C)		0-3V
22	21	Fuel Pump relay	Ignition switch: ON		SV
			Engine: idle speed		0-3V
36	22	Engine warning lamp	Ignition switch: OFF → ON		0-3V → 9-13 (after several seconds have elapsed)
37	52	Power steering pressure switch	Engine: Idling after warmed up	When steering wheel is stationary	SV
				When steering wheel is turned	0-3V
38	49	Control relay (Power supply)	Ignition switch: OFF		SV
			Ignition switch: ON		0-3V
45	83	A/C switch	Engine: idle speed	Turn the A/C switch OFF	0-3V
				Turn the A/C switch ON (A/C compressor is operating)	SV
71	59	Ignition switch – ST	Engine: Cranking		8V or more
72	64	Intake air temperature sensor	Ignition switch: ON	When intake air temperature is 0°C	3.2-3.8V
				When intake air temperature is 20°C	2.3-2.9V
				When engine coolant temperature is 40°C	1.5-2.1V
				When engine coolant temperature is 80°C	0.4-1.0V
76	71	Oxygen sensor	Engine: Running at 2500 rpm after warmed up (Check using a digital type voltmeter)		0 ← → 0.8V (Changes repeatedly)
		Variable resistor	Ignition switch: ON		1-4V
80	66	Backup power supply	Ignition switch: OFF		SV
81	46	Sensor impressed voltage	Ignition switch: ON		4.5-5.5V
82	98	Ignition switch – IG	Ignition switch: ON		SV

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Terminal No.		Check item	Check condition (Engine condition)		Normal condition
M/T	A/T				
83	44	Engine coolant temperature sensor	Ignition switch: ON	When engine coolant temperature is 0°C	3.2-3.8V
				When engine coolant temperature is 20°C	2.3-2.9V
				When engine coolant temperature is 40°C	1.3-1.9V
				When engine coolant temperature is 80°C	0.3-0.9V
84	78	Throttle Position sensor	Ignition switch: ON (Check for smooth voltage increase as throttle valve is moved from idle position to wide open throttle)	Idle	0.3-1.0V
				Wide open throttle valve	4.5-5.5V
—	—	Barometric pressure sensor	Ignition switch: ON	When altitude is 0m	3.7-4.3 V
				When altitude is 1200m	3.2-3.8V
86		Vehicle speed sensor	• Ignition switch: ON • Move the vehicle slowly forward		0 ← → 5V (Changes repeatedly)
87	79	Idle position switch	Ignition switch: ON	Set throttle valve to idle position	0-1V
				Slightly open throttle valve	4V or more
88	56	Top dead centre sensor	Engine: Cranking		0.4-3.0V
			Engine: idle speed		0.5-2.0V
89	45	Crank angle sensor	Engine: Cranking		0.4-4.0V
			Engine: idle speed		1.5-2.5V
90	65	Volume air flow sensor	Engine: idle speed		2.2-3.2V
			Engine: 2500 rpm		
	58	Inhibitor switch <A/T>	Ignition switch: ON	Set selector lever to P or N	0-3V
				Set selector lever to D, 2, 1 or R	8-14V

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CHECK CHART FOR RESISTANCE AND CONTINUITY BETWEEN TERMINALS

1. Turn the ignition switch to OFF.
2. Disconnect the Engine A/T-ECU connector.
3. Measure the resistance and check for continuity between the terminals of the Engine A/T-ECU harness-side connector while referring to the check chart.

NOTE

1. When measuring resistance and checking continuity, a harness for checking contact pin pressure should be used instead of inserting a test probe.
2. Checks do not have to be carried out in the order given in this chart.

Caution

If resistance or continuity checks are performed on the wrong terminals, damage to the vehicle wiring, sensors, Engine A/T-ECU, and/or ohmmeter may occur. Use care to prevent this!

4. If the ohmmeter shows any deviation from the normal condition, check the corresponding sensor, actuator and related electrical wiring, and then repair or replace.
5. After repair or replacement, recheck with the ohmmeter to confirm that the repair or replacement has corrected the problem.

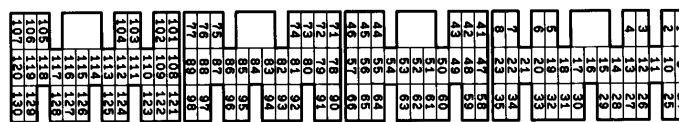
Engine A/T-ECU Harness Side Connector Terminal Arrangement

<M/T>



9FU0392

<A/T>



03AG080N

Terminal No.		Inspection item	Normal condition (Check condition)
<M/T>	<A/T>		
1	1	No. 1 injector	13-16 k Ω (At 20°C)
14	9	No. 2 injector	
2	24	No. 3 injector	
15	2	No. 4 injector	
3	10	No. 5 injector	
16	25	No. 6 injector	
4	14	Stepper motor coil<A1>	28-33 Ω (At 20°C)
17	28	Stepper motor coil<A2>	
5	15	Stepper motor coil<B1>	
18	29	Stepper motor coil<B2>	
6	6	EGR control solenoid valve	34-44 Ω (At 20°C)
24	34	Purge control solenoid valve	34-44 Ω (At 20°C)
13	42	Engine-ECU ground	Continuity (0 Ω)
26	48	Engine-ECU ground	Continuity (0 Ω)

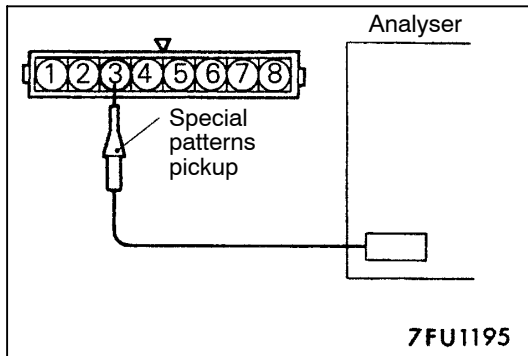
13A MULTIPPOINT FUEL INJECTION – Troubleshooting

Terminal No.		Inspection item	Normal condition (Check condition)
<M/T>	<A/T>		
72	64	Intake air temperature sensor	5.3-6.7 kΩ (When intake air temperature is 0°C)
			2.3-3.0 kΩ (When intake air temperature is 20°C)
			1.0-1.5 kΩ (When intake air temperature is 40°C)
			0.80-0.42 kΩ (When intake air temperature is 80°C)
83	44	Engine coolant temperature sensor	5.1-6.5 kΩ (When engine coolant temperature is 0°C)
			2.1-2.7 kΩ (When engine coolant temperature is 20°C)
			0.9-1.3 kΩ (When engine coolant temperature is 40°C)
			0.26-0.36 kΩ (When engine coolant temperature is 80°C)
87	79	Idle position switch	Continuity (When throttle valve is idle position)
			No Continuity (When throttle valve is slightly open)
	58	Inhibitor switch <A/T>	No Continuity (When select lever is at P or N)
			Continuity (When select lever is at D, 2, 1 or R)

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INSPECTION PROCEDURE USING AN ANALYSER

AIR FLOW SENSOR

Measurement Method

1. Disconnect the air flow sensor connector, and connect the special tool (test harness: EMB991348) in between. (All terminals should be connected.)
2. Connect the analyser special patterns pickup to volume air flow sensor connector terminal 3.

Alternate method (Test harness not available)

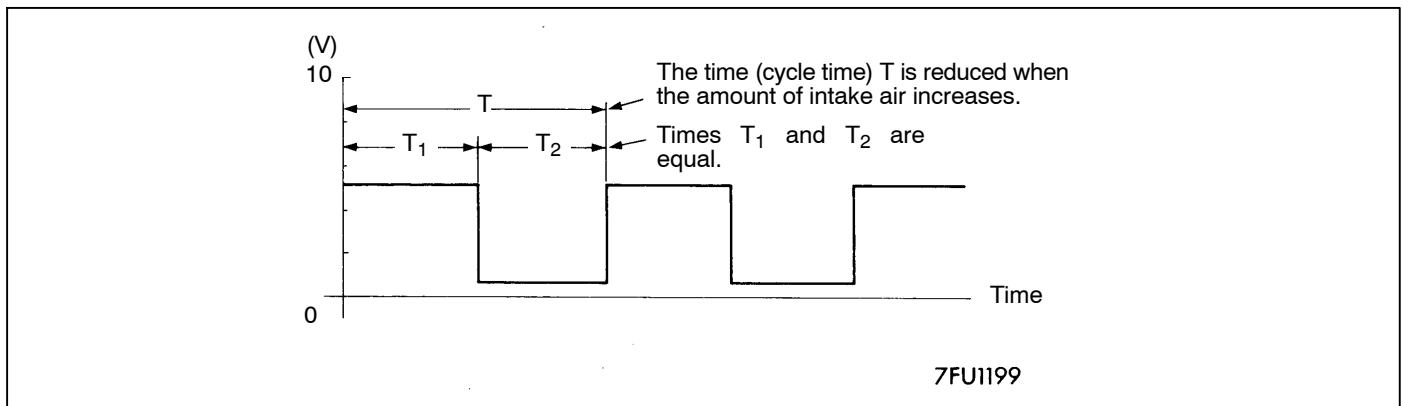
1. Connect the analyser special patterns pickup to Engine-ECU terminal 90 <M/T>, 65 <A/T>.

Standard Wave Pattern

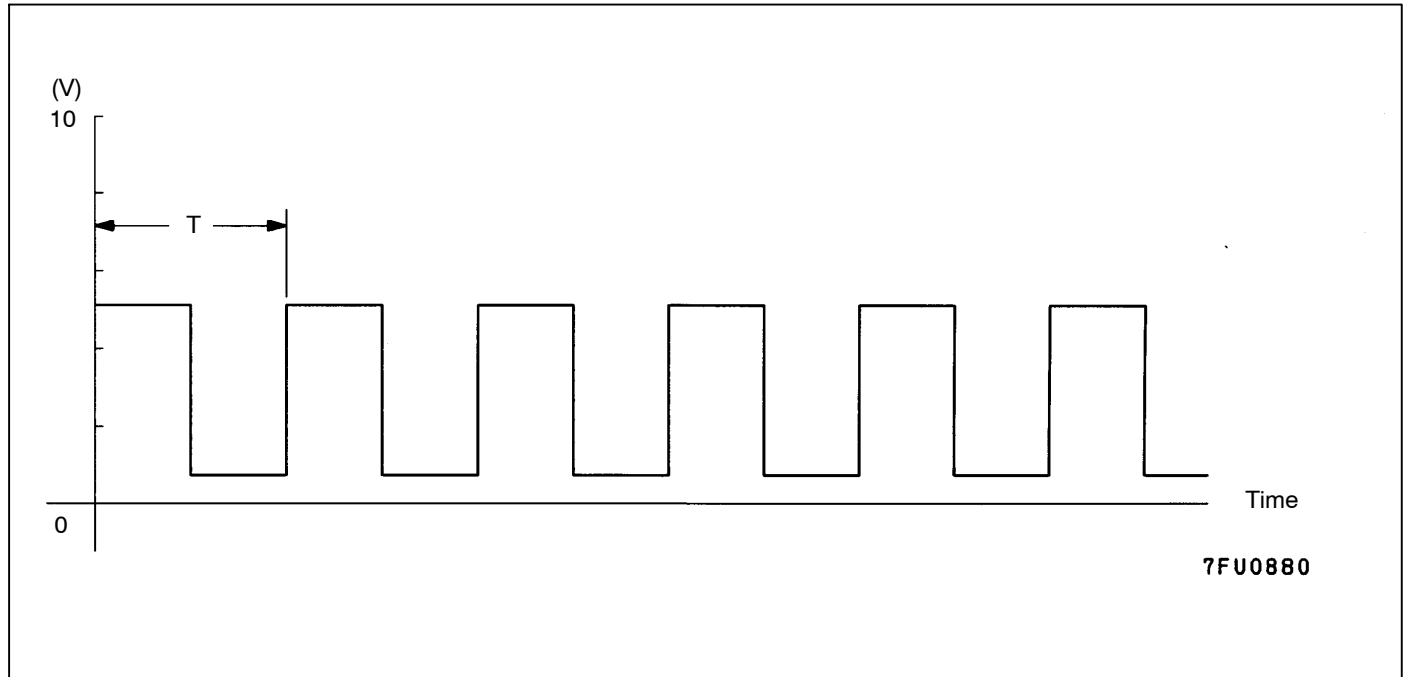
Observation conditions

Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine r/min	Idle

Standard wave pattern

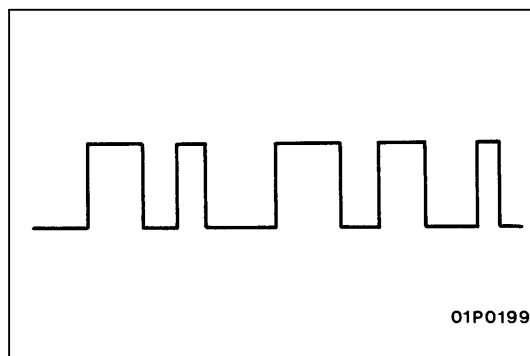


Observation Conditions (pattern changes with engine speed changes.)



Wave Pattern Observation Points

Check to be sure that cycle time T becomes shorter and the frequency increases when the engine speed is increased.



Examples of Abnormal Wave Patterns

- Example 1

CAUSE OF PROBLEM

Sensor interface malfunction

WAVE PATTERN CHARACTERISTICS

Rectangular wave pattern is output even when the engine is not started.

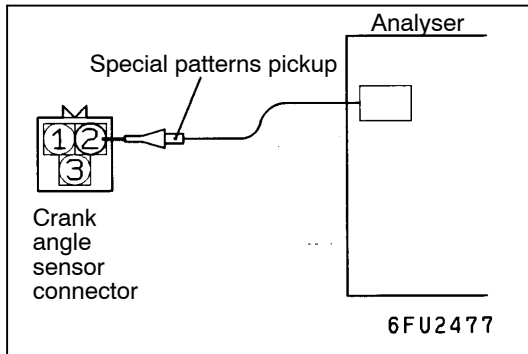
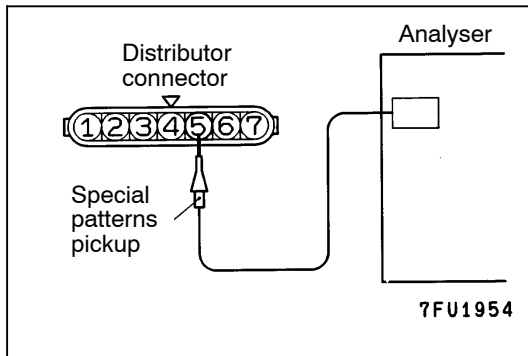
- Example 2

CAUSE OF PROBLEM

Damaged rectifier or vortex generation column

WAVE PATTERN CHARACTERISTICS

Unstable wave pattern with non-uniform frequency. However, when an ignition leak occurs during acceleration, the wave pattern will be distorted temporarily, even if the volume air flow sensor is normal.



CAMSHAFT POSITION SENSOR AND CRANK ANGLE SENSOR

Measurement Method

1. Disconnect the distributor (camshaft position sensor) connector and connect the special tool (test harness: EMB991348) in between. (All terminals should be connected.)
2. Connect the analyser special patterns pickup to distributor connector terminal 5.
3. Disconnect the crank angle sensor connector and connect the special tool (test harness: E8M21) in between.
4. Connect the analyser special patterns pickup to crank angle sensor connector terminal 2.

Alternate method (Test harness not available)

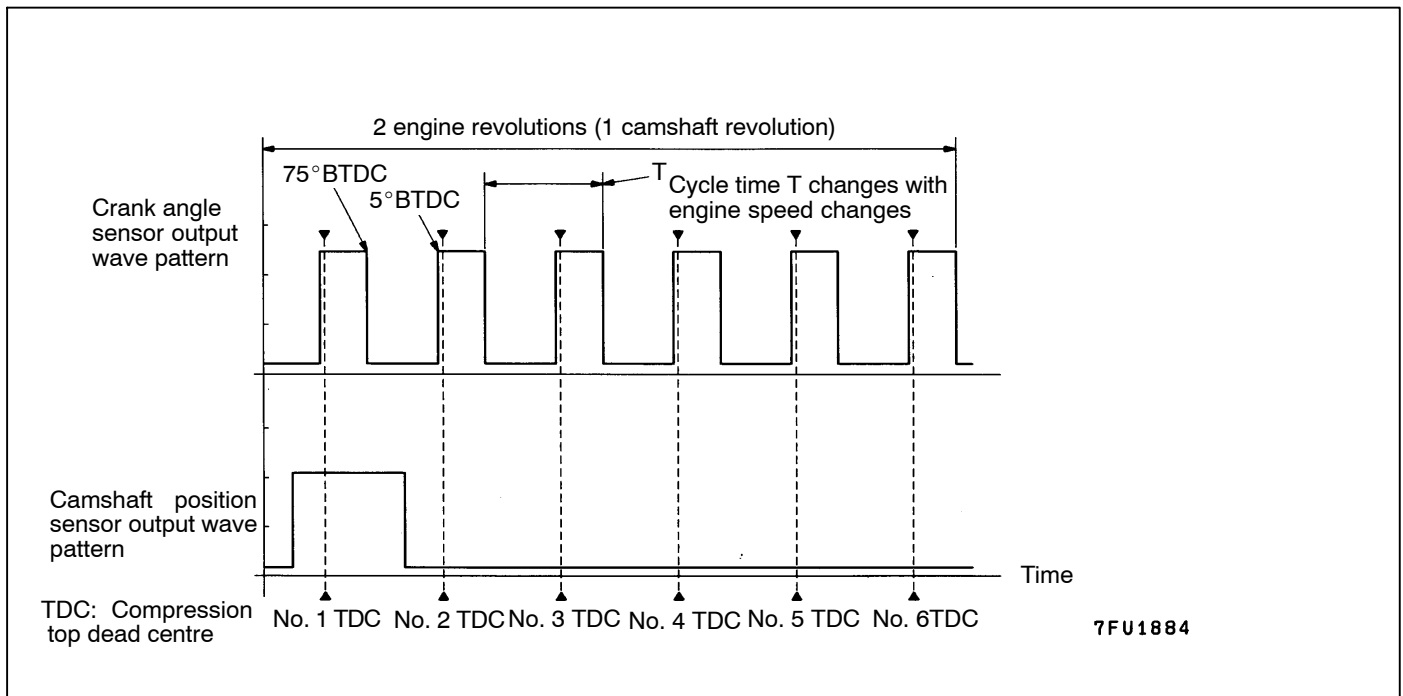
1. Connect the analyser special patterns pickup to Engine ECU terminal 88 <M/T>, 56 <A/T>. (When checking the camshaft position sensor signal wave pattern)
2. Connect the analyser special patterns pickup to Engine ECU terminal 89 <M/T>, 45 <A/T>. (When checking the crank angle sensor signal wave pattern)

Standard Wave Pattern

Observation conditions

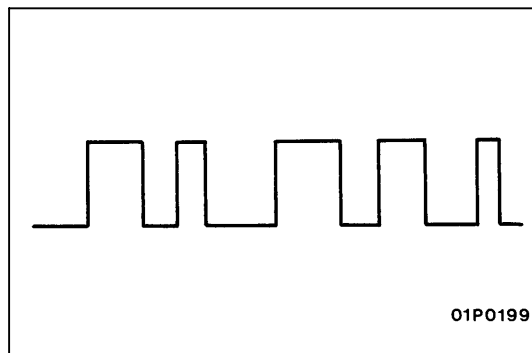
Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine r/min	Idle

Standard wave pattern



Wave Pattern Observation Points

Check to be sure that cycle time T becomes shorter when the engine speed increases.



Examples of Abnormal Wave Patterns

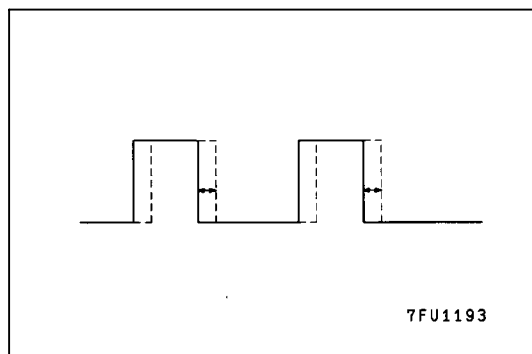
• Example 1

CAUSE OF PROBLEM

Sensor interface malfunction

WAVE PATTERN CHARACTERISTICS

Rectangular wave pattern is output even when the engine is not started.



• Example 2

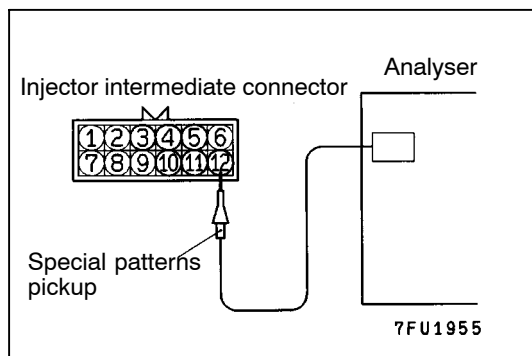
CAUSE OF PROBLEM

Loose timing belt

Abnormality in sensor disk

WAVE PATTERN CHARACTERISTICS

Wave pattern jumps to the left or right.



INJECTOR

Measurement Method

1. Disconnect the injector intermediate connector and connect the special tool (test harness: EMB991348) in between.
2. Connect the analyser special patterns pickup to injector intermediate connector terminal 12 to analyse the No.1 cylinder, connection terminal 5 for No.2 cylinder, connection terminal 11 for No.3 cylinder, connection terminal 4 for No.4 cylinder, connection terminal 10 for No.5 cylinder, connection terminal 3 for No.6 cylinder respectively.

Alternate method (Test harness not available)

<A/T>

1. Connect the analyser special patterns pickup to Engine A/T-ECU terminal 1 to analyse the No.1 cylinder, connection terminal 2 to analyse the No.3 cylinder, connection terminal 3 to analyse the No.5 cylinder, connection terminal 14 to analyse the No.2 cylinder, connection terminal 15 to analyse the No.4 cylinder, and connection terminal 16 to analyse No.6 respectively.

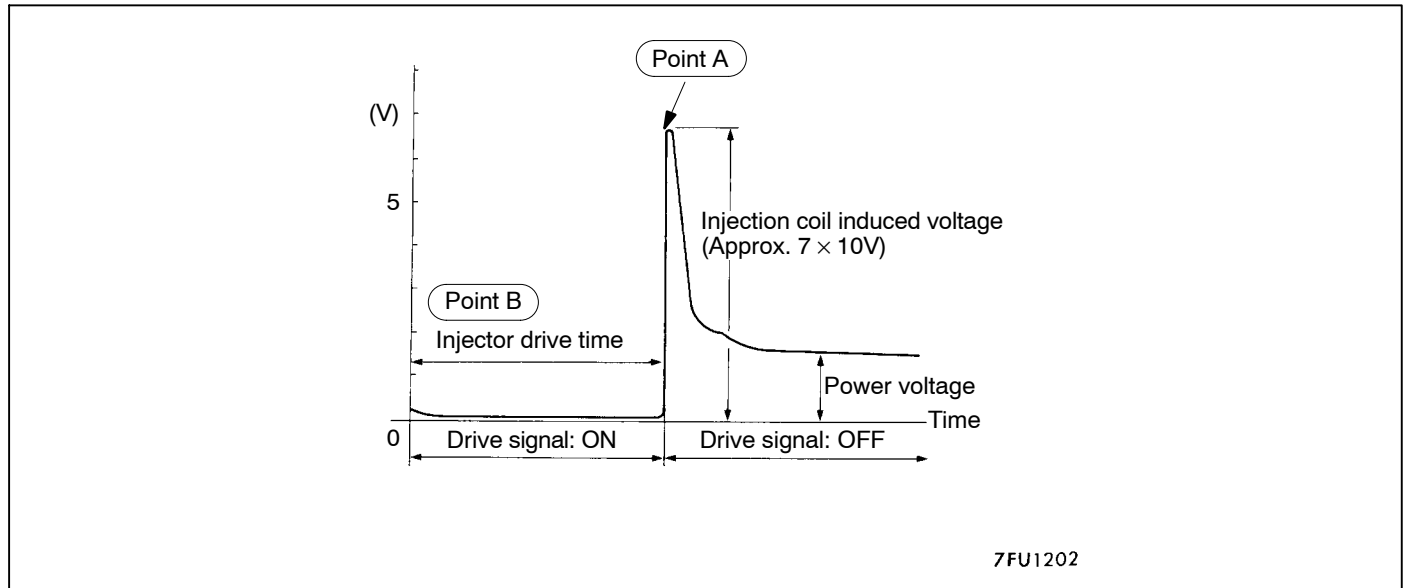
<M/T>

2. Connect the analyser special patterns pickup to Engine ECU terminal 1 to analyse the No.1 cylinder, connection terminal 9 to analyse the No.2 cylinder, connection terminal 24 to analyse the No.3 cylinder, connection terminal 2 to analyse the No.4 cylinder, connection terminal 10 to analyse the No.5 cylinder, and connection terminal 25 to analyse No.6 respectively.

Standard Wave Pattern Observation conditions

Function	Special patterns
Pattern height	Variable
Variable knob	Adjust while viewing the wave pattern
Pattern selector	Display
Engine r/min	Idle

Standard wave pattern

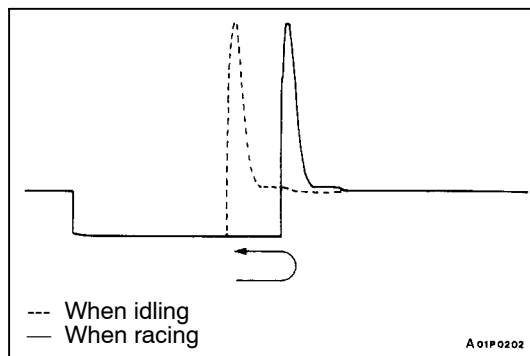


Wave Pattern Observation Points

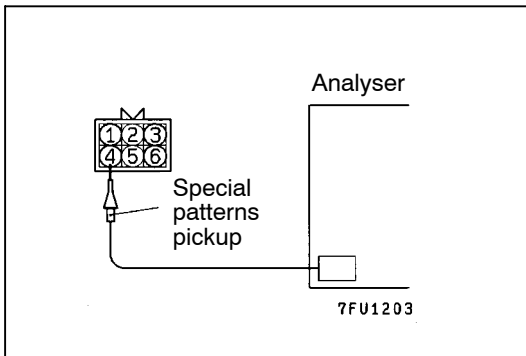
Point A: Height of injector coil induced voltage

Contrast with standard wave pattern	Probable cause
Injector coil induced voltage is low or doesn't appear at all.	Short in the injector solenoid

Point B: Injector drive time



- The injector drive time will be synchronised with the MUT-II tester display.
- When the engine is suddenly raced, the drive time will be greatly extended at first, but the drive time will soon match the engine speed.



ISC STEPPER MOTOR

Measurement Method

1. Disconnect the ISC stepper motor connector, and connect the special tool (test harness: EMB998463) in between.
2. Connect the analyser special patterns pickup to the ISC stepper motor connector terminal 1 (red clip of the special tool), terminal 3 (green clip), terminal 4 (black clip) and terminal 6 (yellow clip) respectively.

Alternate method (Test harness not available)

1. Connect the analyser special patterns pickup to Engine ECU terminals 4, 5, 17, and 18 <M/T>, 14, 15, 28, and 29 <A/T>. (signal wave pattern.)

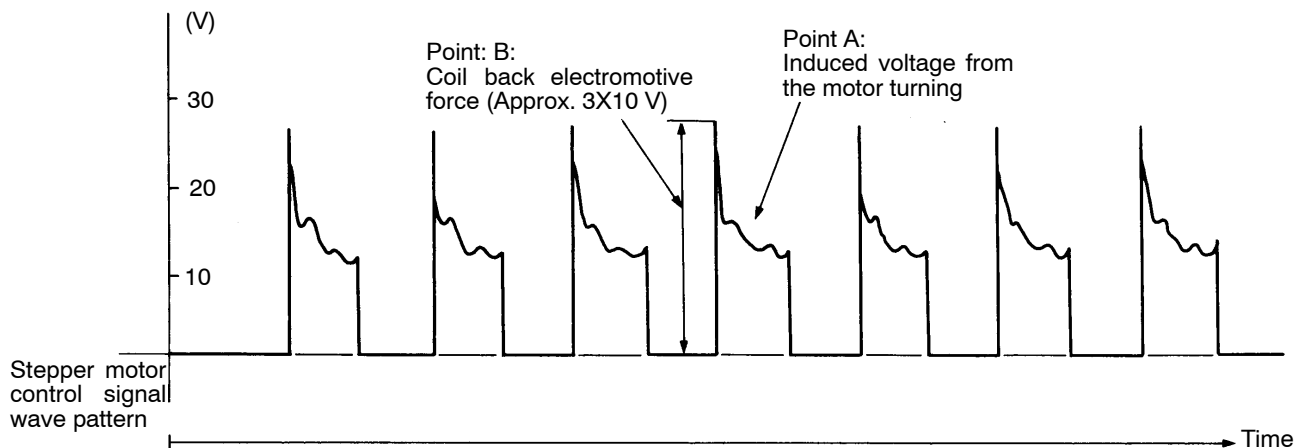
Standard Wave Pattern

Observation conditions

Function	Special patterns
Pattern height	High
Pattern selector	Display
Engine condition	Turn the ignition switch from OFF to ON (without starting the engine).
	While the engine is idling, turn the A/C switch to ON.
	Immediately after starting the warm engine (approx. 1 minute).

Standard wave pattern

The wave pattern appears for an instant, but soon disappears.



Wave Pattern Observation Points

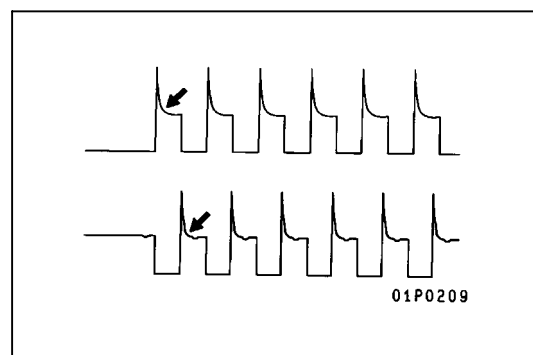
Check that the standard wave pattern appears when the idle air control motor is operating.

Point A: Condition of wave pattern build-up section and maximum voltage (Refer to abnormal wave pattern.)

Contrast with standard wave pattern	Probable cause
Induced electromotive force does not appear or is extremely small.	Malfunction of motor

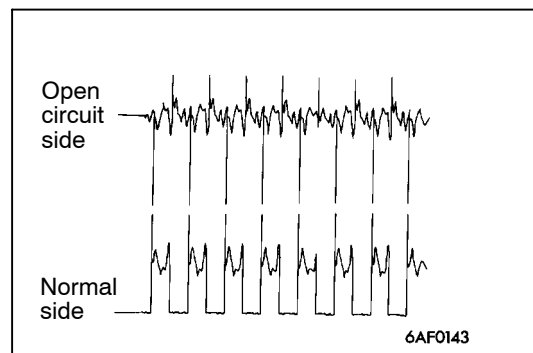
Point B: Height of coil back electromotive force.

Contrast with standard wave pattern	Probable cause
Coil reverse electromotive force does not appear or is extremely small.	Short in coil

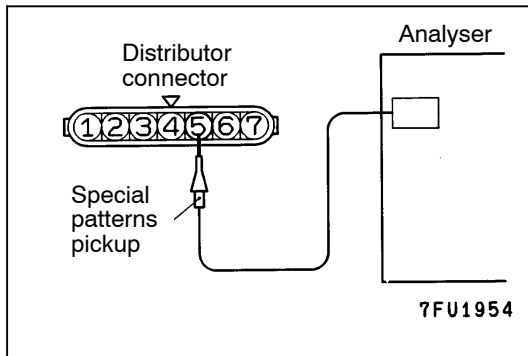


Examples of Abnormal Wave Patterns

- Example 1
CAUSE OF PROBLEM
Malfunction of motor (Motor is not operating.)
WAVE PATTERN CHARACTERISTICS
Induced electromotive force from the motor turning does not appear.



- Example 2
CAUSE OF PROBLEM
Open circuit in the line between the ISC stepper motor and Engine A/T-ECU.
WAVE PATTERN CHARACTERISTICS
Current is not supplied to the motor coil on the open circuit side. (Voltage does not drop to 0 V.)
Furthermore, the induced electromotive force wave pattern at the normal side is slightly different from the normal wave pattern.



IGNITION COIL AND IGNITION POWER TRANSISTOR

- Ignition coil primary signal
Refer [On Vehicle Service](#).
- Ignition power transistor control signal

Measurement Method

1. Disconnect the distributor (ignition power transistor) connector, and connect the special tool (test harness: EMB991348) in between. (All terminals should be connected.)
2. Connect the analyser special patterns pickup to distributor connector terminal 5.

Alternate method (Test harness not available)

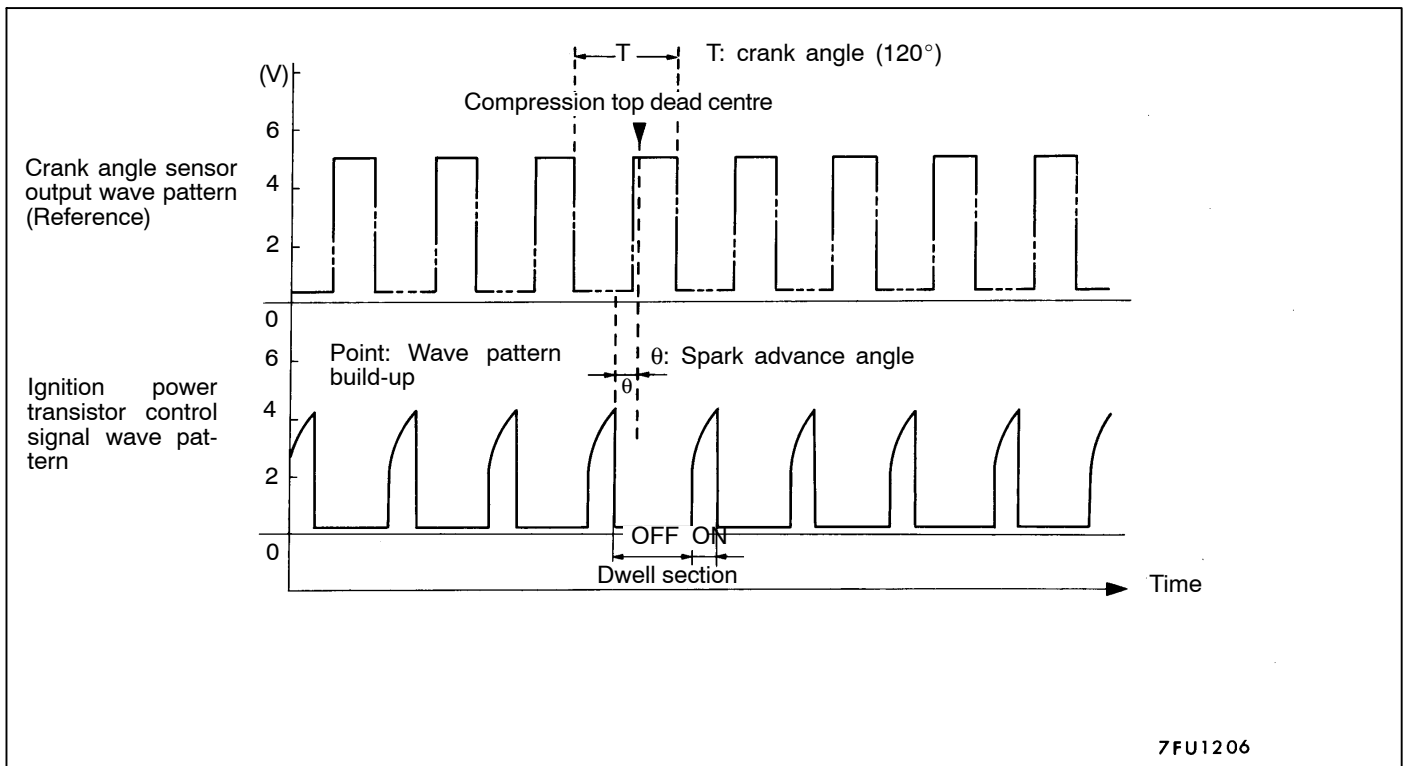
1. Connect the analyser special patterns pickup to Engine ECU terminal 10 <M/T>, 11 <A/T>.

Standard Wave Pattern

Observation conditions

Function	Special patterns
Pattern height	Low
Pattern selector	Display
Engine r/min	Approx. 1,200 r/min

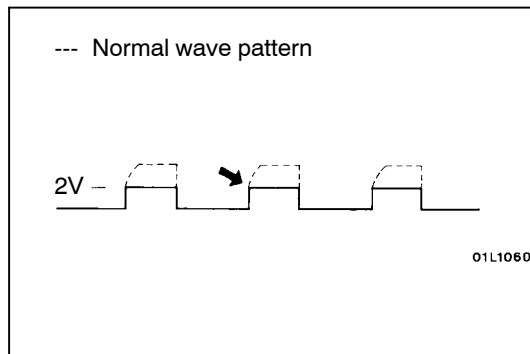
Standard wave pattern



Wave Pattern Observation Points

Point: Condition of wave pattern build-up section and maximum voltage (Refer to abnormal wave pattern examples 1 and 2.)

Condition of wave pattern build-up section and maximum voltage	Probable cause
Rises from approx. 2V to approx. 4.5V at the top-right	Normal
2V rectangular wave	Open-circuit in ignition primary circuit
Rectangular wave at power voltage	Ignition power transistor malfunction



Examples of Abnormal Wave Patterns

- Example 1

Wave pattern during engine cranking

CAUSE OF PROBLEM

Open-circuit in ignition primary circuit

WAVE PATTERN CHARACTERISTICS

Top-right part of the build-up section cannot be seen, and voltage value is approximately 2V too low.
- Example 2

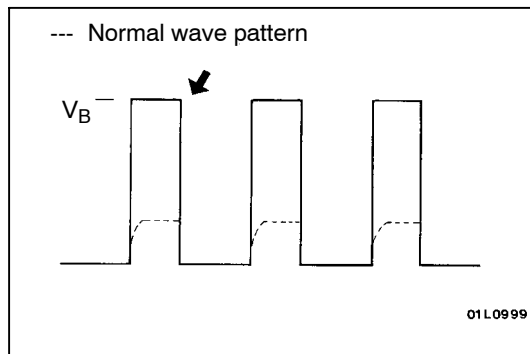
Wave pattern during engine cranking

CAUSE OF PROBLEM

Malfunction in ignition power transistor

WAVE PATTERN CHARACTERISTICS

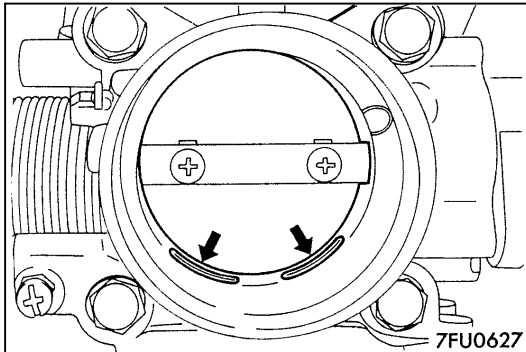
Power voltage results when the ignition power transistor is ON.



ON-VEHICLE SERVICE

THROTTLE BODY (THROTTLE VALVE AREA) CLEANING

1. Start the engine and warm it up until the coolant is heated to 80°C or higher and then stop the engine.
2. Remove the air intake hose from the throttle body.



3. Plug the bypass passage inlet (arrow) of the throttle body.

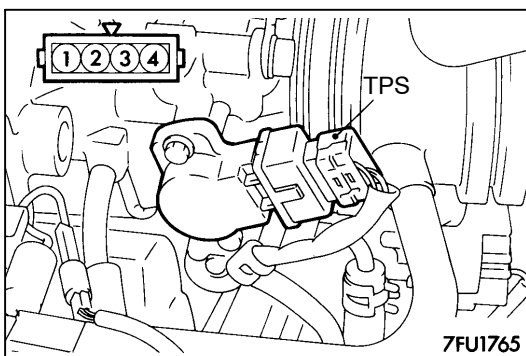
Caution

Do not allow cleaning solvent to enter the bypass passage.

4. Spray cleaning solvent into the valve through the throttle body intake port and leave it for about 5 minutes.
5. Start the engine, race it several times and idle it for about 1 minute. If the idling speed becomes unstable (or if the engine stalls) due to the bypass passage being plugged, slightly open the throttle valve to keep the engine running.
6. If the throttle valve deposits are not removed, repeat steps 4 and 5.
7. Unplug the bypass passage inlet.
8. Attach the air intake hose.
9. Use the MUT-II to erase the diagnosis trouble code.
10. Adjust the basic idle speed. (Refer [On Vehicle Service](#).)

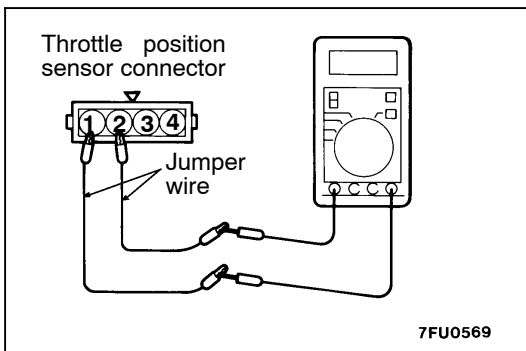
NOTE

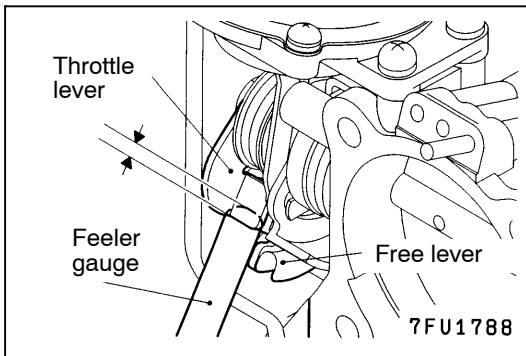
If the engine hunts while idling after adjustment of the basic idle speed, disconnect the (–) cable from the battery for 10 seconds or more, and then reconnect it and run the engine at idle for about 10 minutes.



CLOSED THROTTLE POSITION SWITCH AND THROTTLE POSITION SENSOR ADJUSTMENT <Vehicles without TCL>

1. Connect the MUT-II to the data link connector. When not using the MUT-II, proceed as follows.
 - (1) Disconnect the connector of the throttle position sensor.
 - (2) Connect an ohmmeter between terminal 2 (closed throttle position switch) and 1 (sensor ground) by using jumper wires.

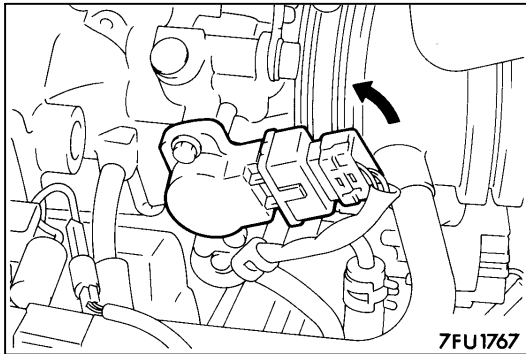




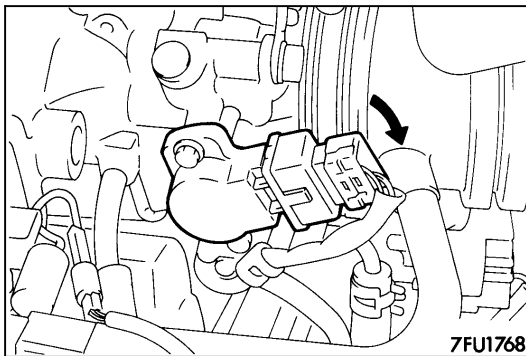
2. Insert a feeler gauge with a thickness of 1.4 mm between the levers shown in the illustration to a depth of no more than 3 mm

NOTE: Inserting the feeler gauge more than 3mm will result in incorrect adjustment.

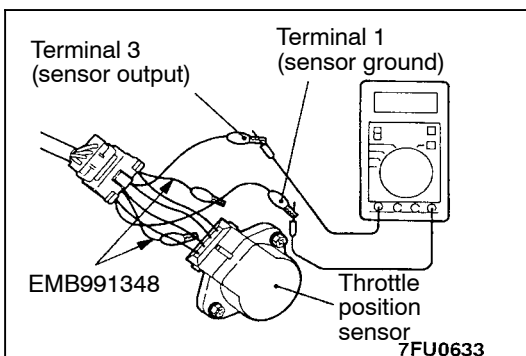
3. When using the MUT-II, turn the ignition switch ON. (Engine does not start.)



4. Loosen the throttle position sensor mounting bolt; then turn the throttle position sensor body fully counter clockwise.
5. In this condition, make sure that the closed throttle position switch is ON. (There is continuity between terminals 1 and 2.)



6. Slowly turn the throttle position sensor clockwise until the point at which the idle switch is turned OFF (continuity between terminals 1 and 2 changes to non-continuity) is found. Tighten the throttle position sensor installation bolt at that position.



7. When not using the MUT-II, proceed as follows:
 - (1) Connect the special tool (test harness set) between the throttle position sensor connectors which have been disconnected. (Connect all terminals taking care not to mistake the terminal No.)
 - (2) Connect a digital voltmeter between the throttle position sensor terminal 1 (sensor ground) and terminal 3 (sensor output.)
 - (3) Turn the ignition switch ON (but do not start the engine).

8. Check the throttle position sensor output voltage.

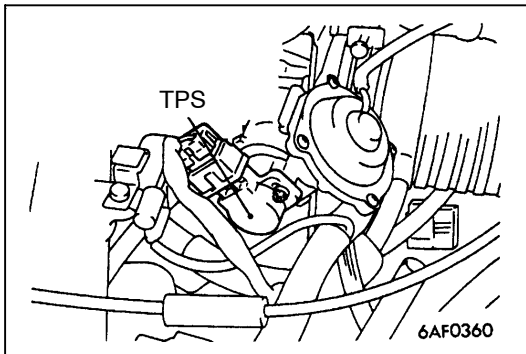
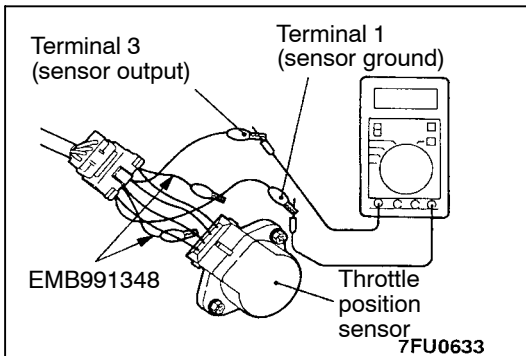
Standard value: 400–1,000 mV

9. If there is a deviation from the standard value, check the throttle position sensor and the related harness.
10. Remove the feeler gauge.
11. Switch OFF the ignition switch.

THROTTLE POSITION SENSOR ADJUSTMENT <Vehicles with TCL>

1. Connect the MUT-II to the data link connector. When not using the MUT-II, proceed as follows.
 - (1) Disconnect the connector of the throttle position sensor and connect the special tool (test harness: EMB991348) in between.
 - (2) Connect a digital voltmeter between terminal 3 (sensor output) and terminal 1 (sensor ground).
2. Turn the ignition switch to ON (but do not start the engine).
3. Check the throttle position sensor output voltage.

Standard value: 580–690 mV

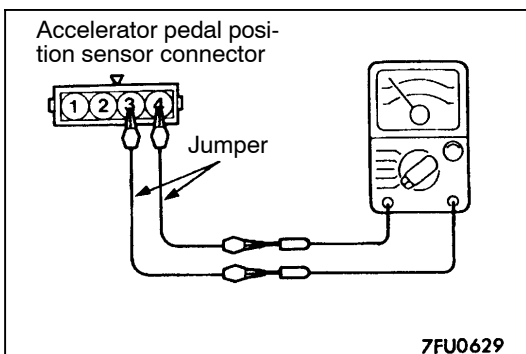
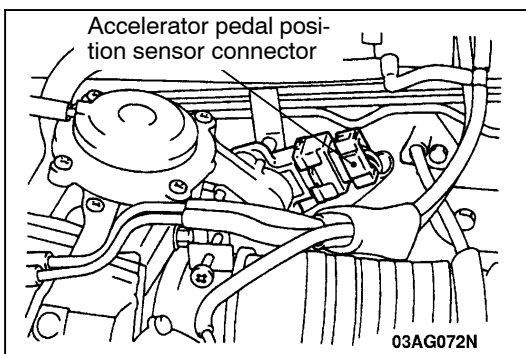


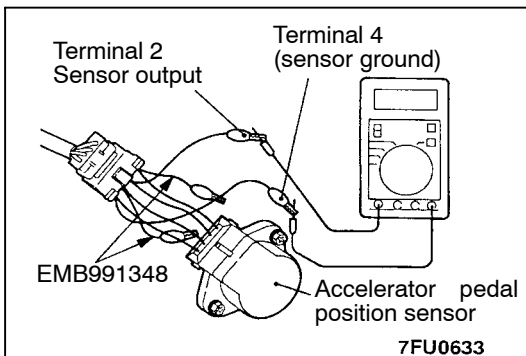
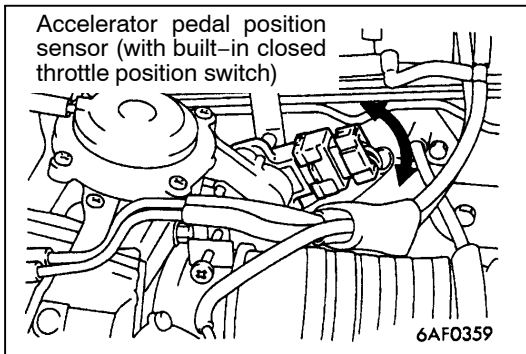
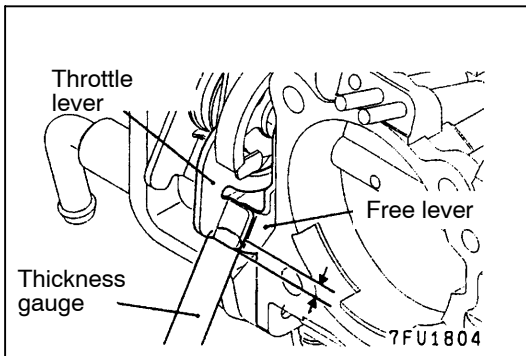
4. If the voltage is outside the standard value, adjust by loosening the throttle position sensor mounting bolts and turning the throttle position sensor body. After adjusting, tighten the bolts securely.
5. Turn the ignition switch to OFF.
6. If a diagnosis trouble code is output while adjusting the throttle position sensor, use the MUT-II to erase the diagnosis trouble code, or disconnect the battery negative cable from the battery terminal for 10 seconds or more, and then reconnect the cable and run the engine at idle speed for approx. 10 minutes.

CLOSED THROTTLE POSITION SWITCH AND ACCELERATOR PEDAL POSITION SENSOR ADJUSTMENT

<Vehicles with TCL>

1. Connect the MUT-II to the data link connector. When not using the MUT-II, proceed as follows.
 - (1) Disconnect the connector of the accelerator pedal position sensor.
- (2) Connect an ohmmeter between terminal 3 (closed throttle position switch) and terminal 4 (sensor ground) by using jumper wires.





2. Insert a feeler gauge with a thickness of 0.85 mm between the levers shown in the illustration to a depth of no more than 3 mm

NOTE: Inserting the feeler gauge more than 3mm will result in incorrect adjustment.

3. Turn the ignition switch to ON (but do not start the engine).

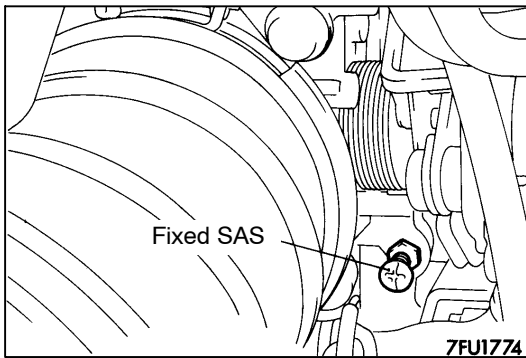
4. Loosen the accelerator pedal position sensor mounting bolt; then turn the accelerator pedal position sensor body counter clockwise as far as it will go.
5. In this condition, make sure that the closed throttle position switch is ON. (There is continuity between terminals 3 and 4.)
6. Slowly turn the accelerator pedal position sensor clockwise until the point at which the closed throttle position switch is turned OFF (continuity between terminals 1 and 2 changes to non-continuity) is found. Tighten the accelerator pedal position sensor installation bolt at that position.

7. When using the MUT-II, select "Traction Control System". When not using the MUT-II, proceed as follows.
 - (1) Disconnect the accelerator pedal position sensor connector and connect the special tool (test harness: EMB991348) in between.
 - (2) Connect a digital voltmeter between terminal 2 (sensor output) and terminal 4 (sensor ground).
 - (3) Turn the ignition switch to ON (but do not start the engine).
8. Check the accelerator pedal position sensor output voltage.

Standard value: 400–1,000 mV

9. If the voltage is outside the standard value, check the accelerator pedal position sensor and related harnesses.
10. Remove the feeler gauge.
11. Turn the ignition switch to OFF.
12. Disconnect the MUT-II.

When the MUT-II is not used, remove the special tool and connect the accelerator pedal position sensor.



FIXED SAS ADJUSTMENT

NOTE

1. The fixed SAS should not be moved unnecessarily; it has been precisely adjusted by the manufacturer.
2. If the adjustment is disturbed for any reason, readjust as follows.
1. Loosen the tension of the accelerator cable sufficiently.
2. Back out the fixed SAS lock nut.
3. Turn the fixed SAS anti-clockwise until it is sufficiently backed out, and fully close the throttle valve.
4. Turn the fixed SAS clockwise until the throttle lever is touched (i.e., the point at which the throttle valve begins to open).
From that point, turn the fixed SAS clockwise another 1-1/4 turn.
5. While holding the fixed SAS so that it doesn't move, tighten the lock nut securely.
6. Adjust the tension of the accelerator cable.
7. Adjust the basic idle speed.
8. Adjust the closed throttle position switch and the [throttle position sensor <vehicles without TCL>](#), [throttle position sensor <vehicles with TCL>](#), [closed throttle position switch and accelerator pedal position sensor <vehicles with TCL>](#).

BASIC IDLE SPEED ADJUSTMENT

NOTE

1. The standard idle speed has been adjusted, by the engine speed adjusting screw, by the manufacturer, and there should usually be no need for readjustment.
2. The adjustment, if made, should be made after first confirming that the spark plugs, the injectors, the ISC servo, the compression pressure, etc., are all normal.
1. The vehicle should be set in the pre-adjustment condition before inspection and adjustment.
2. Connect the MUT-II to the data link connector (16-pin)

NOTE

When the MUT-II is connected, the diagnosis control terminal should be grounded.

3. Start the engine and run at idle.
4. Select item No. 30 of the **MUT-II** [Actuator Test](#).

NOTE

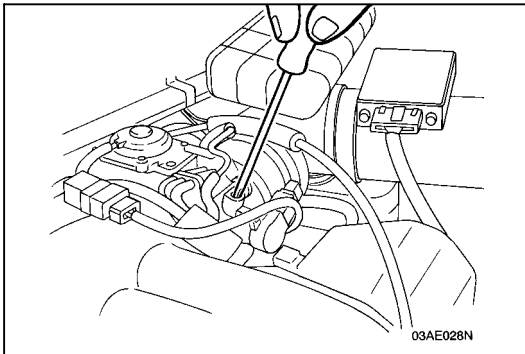
This holds the ISC servo at the basic step to adjust the basic idle speed.

5. Check the idle speed.

Standard value: 700 ± 100 r/min

NOTE

1. The engine speed may be 20 to 100 r/min lower than indicated above for a new vehicle [driven approximately 500 km or less], but no adjustment is necessary.
2. If the engine stalls or the rpm is low even though the vehicle has been driven approximately 500 km or more, it is probable that deposits are adhered to the throttle valve, so clean it.
(Refer [On Vehicle Service](#).)



6. If not within the standard value range, turn the engine speed adjusting screw to make the necessary adjustment.

NOTE

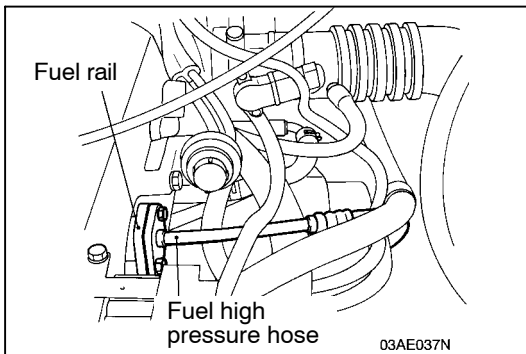
If the idling speed is higher than the standard value range even when the engine speed adjusting screw is fully closed, check whether or not there is any indication that the fixed SAS has been moved. If there is an indication that it has been moved, adjust the fixed SAS.

7. Press the clear key and release the ISC servo from the ACTUATOR TEST mode.

NOTE

Unless the ISC servo is released, the ACTUATOR TEST mode will continue 27 minutes.

8. Switch OFF the ignition switch.
9. Disconnect the MUT-II.
10. Start the engine again and let it run at idle speed for about 10 minutes; check that the idling condition is normal.

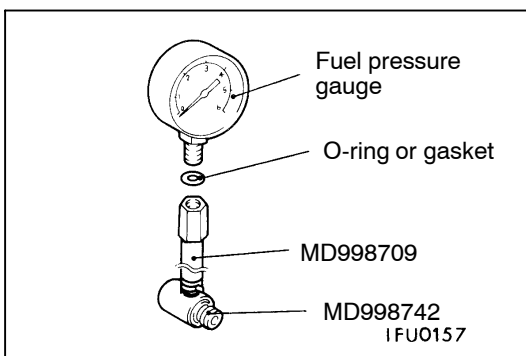


FUEL PRESSURE TEST

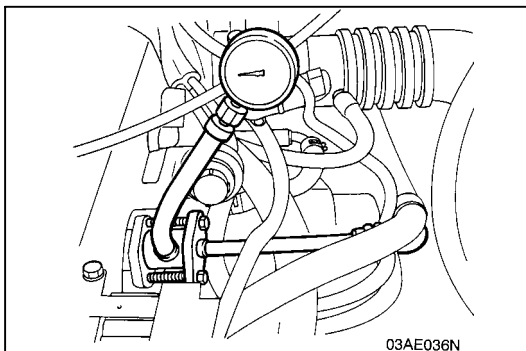
1. Release residual pressure from the fuel line to prevent fuel spray. (Refer [On Vehicle Service](#).)
2. Disconnect the fuel high pressure hose at the fuel rail side.

Caution

Cover the hose connection with rags to prevent splash of fuel that could be caused by some residual pressure in the fuel pipe line.

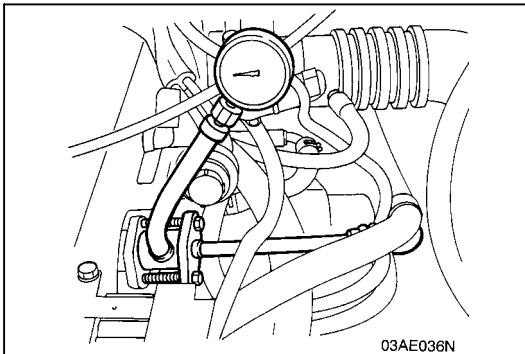


3. Remove the union joint and bolt from the special tool (adaptor hose MD998709) and instead attach the special tool (hose adaptor MD998742) to the adaptor hose.
4. Install a fuel pressure gauge on the adaptor hose that was set up in step 3.
Use a suitable O-ring or gasket between the fuel pressure gauge and the special tool so as to seal in order to prevent fuel leakage at this time.



5. Install the special tool, which was assembled in steps 3 and 4 between the fuel rail and the high pressure hose.

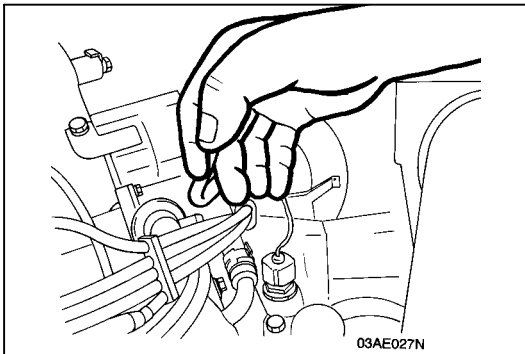
6. Use the MUT-II to operate the fuel pump. Check the connections between the fuel pressure gauge and the special tool for leaks.
7. Start the engine and run at idle.



8. Measure fuel pressure while the engine is running at idle.

Standard value:

Approx. 270 kPa at curb idle



9. Disconnect and plug the vacuum hose from the fuel pressure regulator and measure fuel pressure with the hose end closed by a finger.

Standard value:

330–350 kPa at curb idle

10. Check to see that fuel pressure at idle does not drop even after the engine has been raced several times.
11. Racing the engine repeatedly, hold the fuel return hose lightly with fingers to feel that fuel pressure is present in the return hose.

NOTE

If the fuel flow rate is low, there will be no fuel pressure in the return hose.

12. If any of fuel pressure measured in steps 8 to 11 is out of specification, troubleshoot and repair according to the table below.

Symptom	Probable cause	Remedy
<ul style="list-style-type: none"> Fuel pressure too low Fuel pressure drops after racing No fuel pressure in fuel return hose 	Clogged fuel filter	Replace fuel filter
	Fuel leaking to return side due to poor fuel regulator valve seating or settled spring	Replace fuel pressure regulator
	Low fuel pump delivery pressure	Replace fuel pump
Fuel pressure too high	Binding valve in fuel pressure regulator	Replace fuel pressure regulator
	Clogged fuel return hose or pipe	Clean or replace hose or pipe
Same fuel pressure when vacuum hose is connected and when disconnected	Damaged vacuum hose or clogged nipple	Replace vacuum hose or clean nipple

13. Stop the engine and observe fuel pressure gauge reading. Normal if the reading does not drop within 2 minutes. If it does, observe the rate of drop and troubleshoot and repair according to the table below.

Symptom	Probable cause	Remedy
Fuel pressure drops gradually after engine is stopped	Leaky injector	Replace injector
	Leaky fuel regulator valve seat	Replace fuel pressure regulator
Fuel pressure drops sharply immediately after engine is stopped	Check valve in fuel pump is held open	Replace fuel pump

14. Release residual pressure from the fuel pipe line. (Refer [On Vehicle Service](#).)
15. Remove the fuel pressure gauge and special tool from the fuel rail.

Caution

Cover the hose connection with rags to prevent splash of fuel that could be caused by some residual pressure in the fuel pipe line.

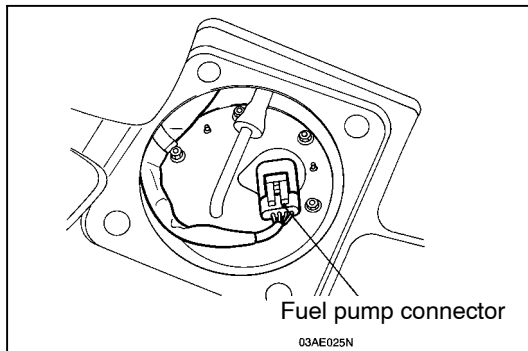
16. Replace the O-ring at the end of the fuel high pressure hose with a new one.
17. Fit the fuel high pressure hose into the fuel rail and tighten the bolts to specified torque.

Tightening torque: 5 Nm

18. Check for fuel leaks.
 - (1) Use the MUT-II to operate the fuel pump.
 - (2) Check the fuel line for leaks, repair as needed.

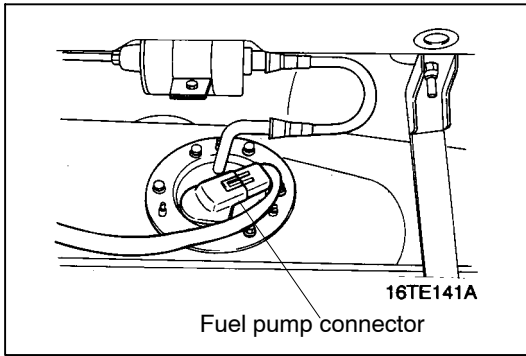
FUEL PUMP CONNECTOR DISCONNECTION (HOW TO REDUCE PRESSURISED FUEL LINES)

When removing the fuel pipe, hose, etc., since fuel pressure in the fuel pipe line is high, do the following operation so as to release fuel pressure in the line and prevent fuel from running out.



<SEDAN> and <AWD>

1. Remove the rear seat cushion. (Refer [Rear seat cushion removal and installation](#).)
2. Remove the fuel pump/fuel gauge floor cover plate and disconnect the wiring connector at the fuel pump/gauge assembly.
3. Start the engine and let it run until it stops naturally, turn the ignition switch to OFF.
4. Re-connect the fuel pump/gauge wiring harness connector.
5. Install the rear seat cushion.



<WAGON>

1. Disconnect the wiring connector at the left front corner of the fuel tank.
2. Start the engine and let it run until it stops naturally, turn the ignition switch to OFF.
3. Re-connect the fuel pump/gauge wiring harness connector.

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FUEL PUMP OPERATION CHECK

1. Check the operation of the fuel pump by using the MUT-II to force-drive the fuel pump.

NOTE

As the fuel pump is an in-tank type, the fuel pump sound is hard to hear, so remove the fuel tank filler tube cap and check from the tank inlet.

NOTE

Check the fuel pressure by pinching the fuel hose with the fingertips.

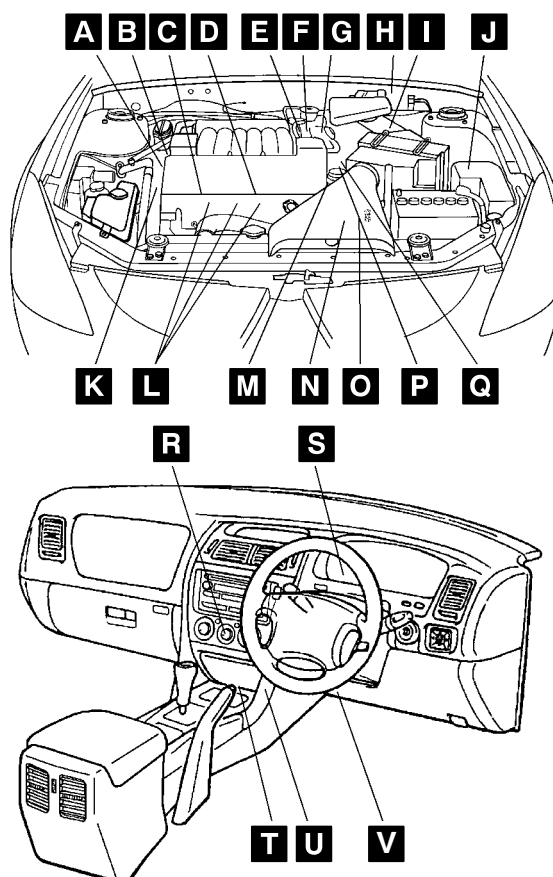
INSPECTION OF MPI COMPONENTS

COMPONENT LOCATION

Name	Symbol	Name	Symbol
Accelerator pedal position sensor	F	Ignition coil and ignition power transistor <in distributor>	P
Air conditioning compressor clutch relay	J	Inhibitor switch	O
Air conditioner switch	R	Injector	L
Air flow sensor (with built-in intake air temperature sensor and barometric pressure sensor)	I	Multipoint fuel injection (MPI) relay/Fuel pump relay	U
Camshaft position sensor <in distributor>	Q	Oxygen sensor	B
Crank angle sensor	K	Power steering pressure switch	A
Data link connector	V	Purge control solenoid valve	C
EGR control solenoid valve	D	Throttle position sensor (with built-in closed throttle position switch)	E
Engine coolant temperature sensor	M	Vacuum control solenoid <Vehicles with TCL>	H
Engine A/T-ECU	T	Ventilation control solenoid valve <Vehicles with TCL>	H
Engine warning lamp (check engine lamp)	S	Vehicle speed sensor	N
Idle speed control servo	G		

NOTE

The “Name” column is arranged in alphabetical order.

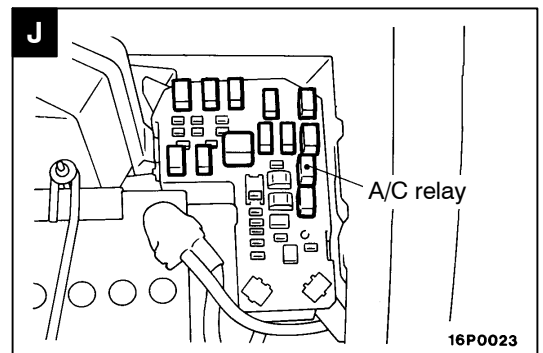
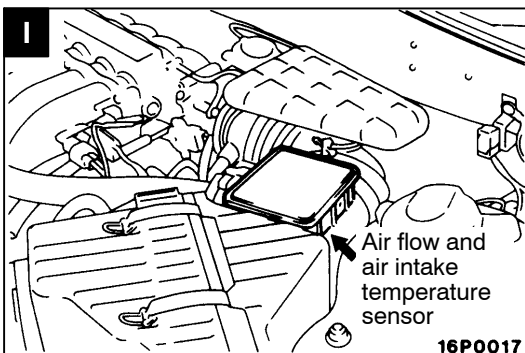
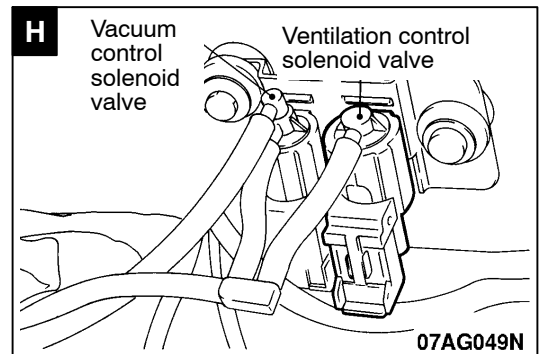
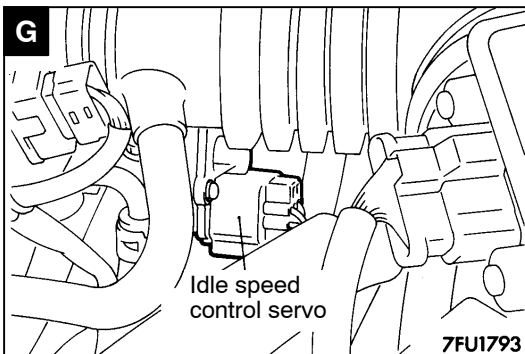
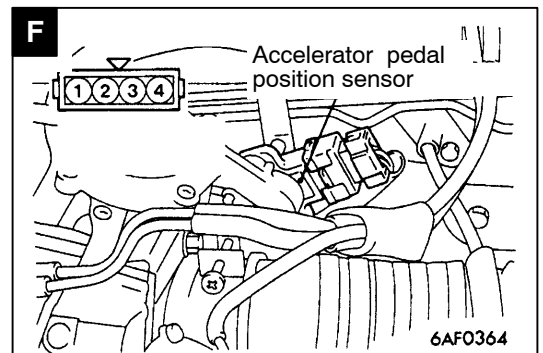
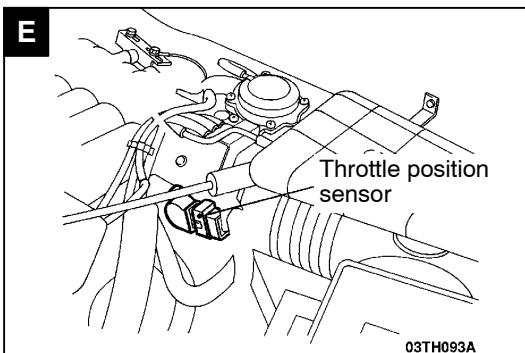
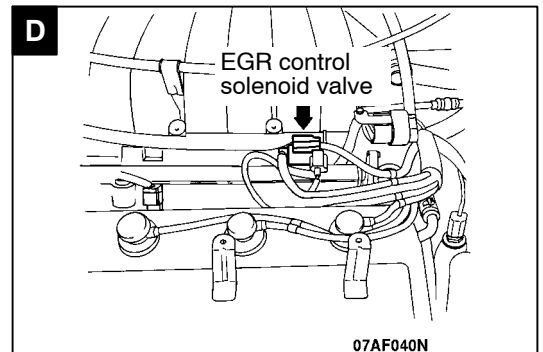
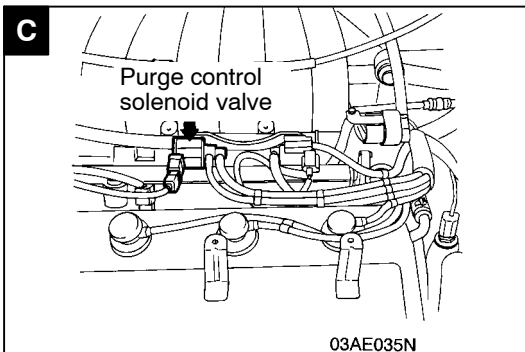
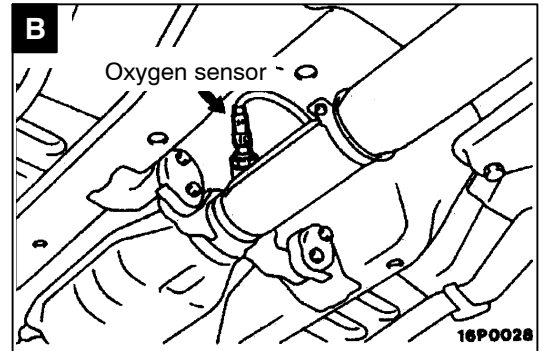
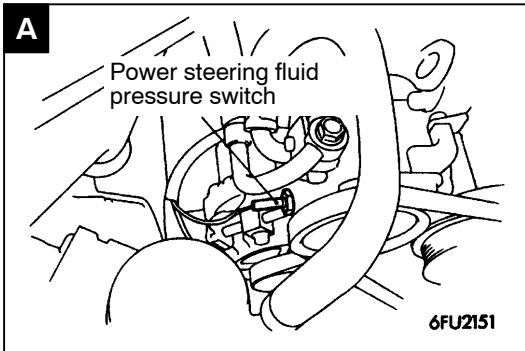


13A MULTIPOINT FUEL INJECTION – Inspection of MPI Components

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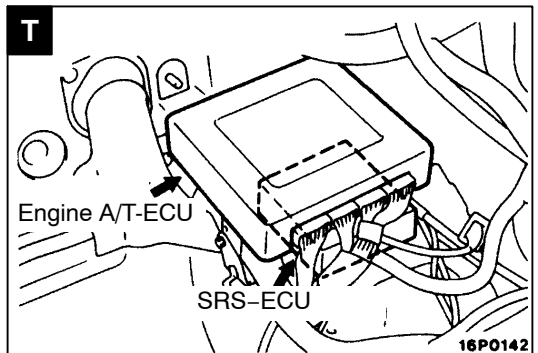
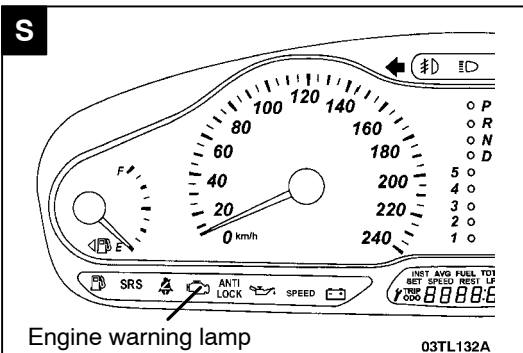
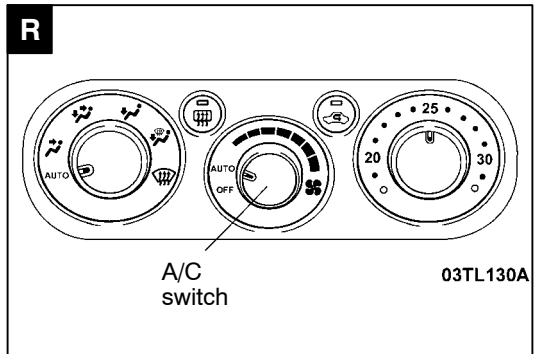
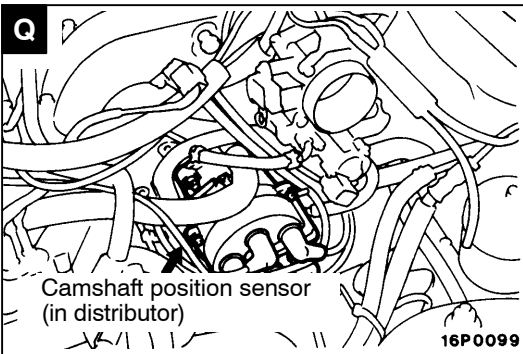
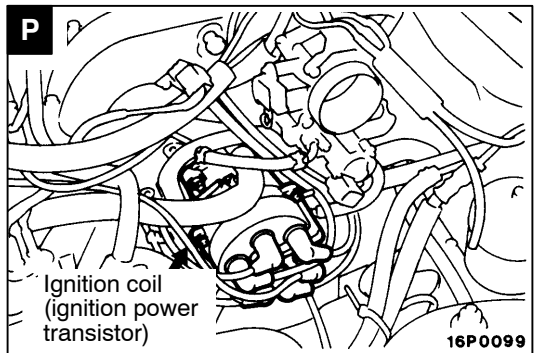
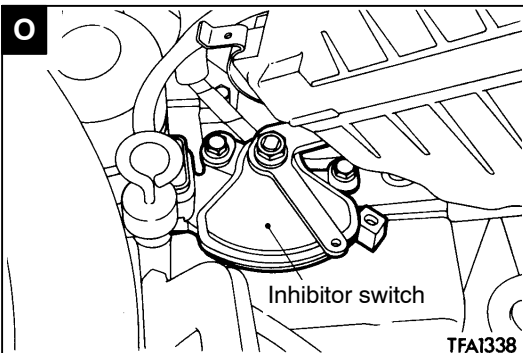
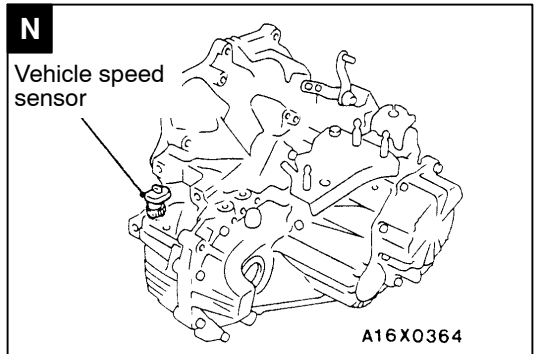
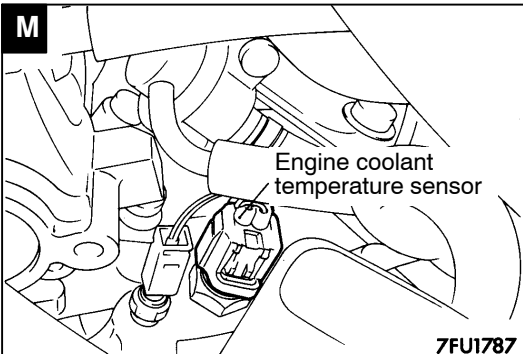
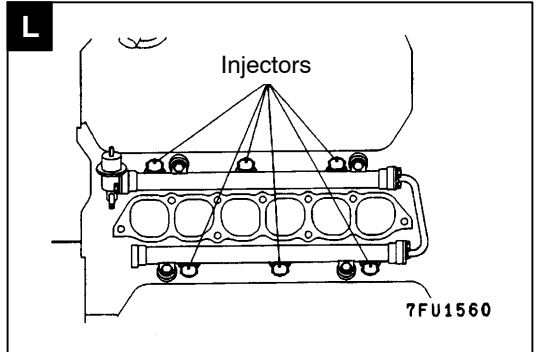
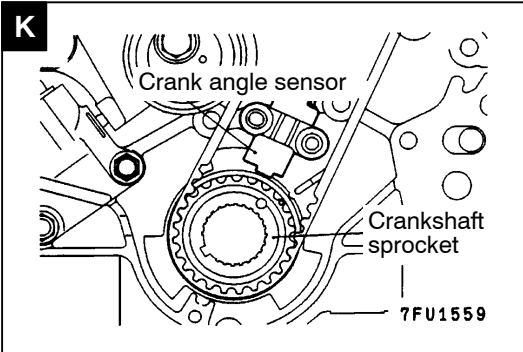


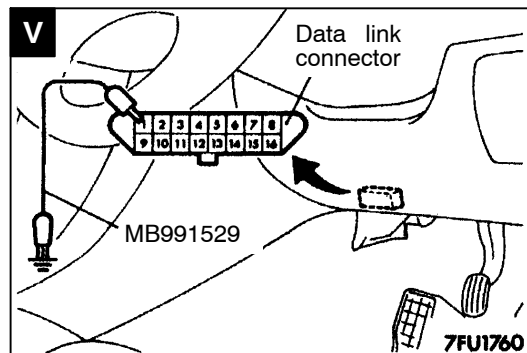
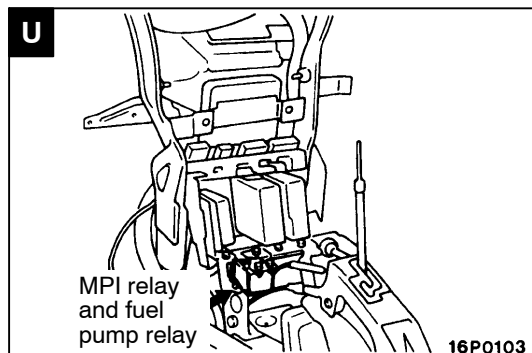
13A MULTIPOINT FUEL INJECTION – Inspection of MPI Components

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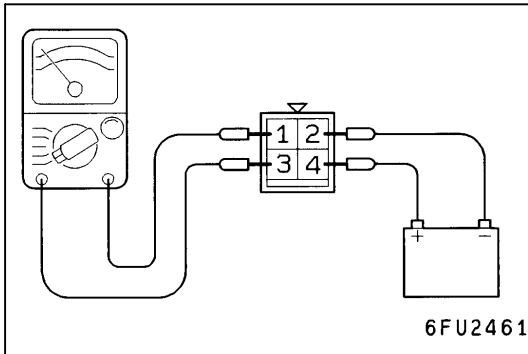




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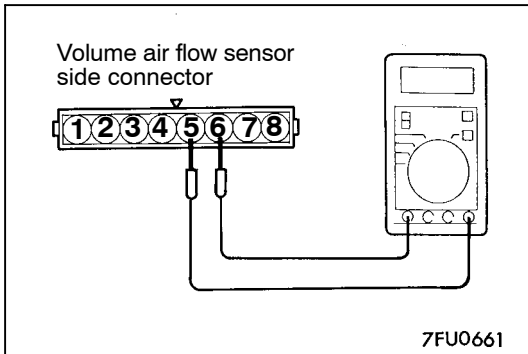
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MPI CONTROL RELAY AND FUEL PUMP RELAY CONTINUITY CHECK

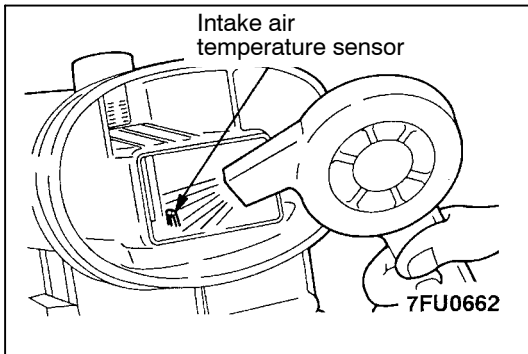
Battery voltage	Terminal No.			
	1	2	3	4
Not supplied		○		○
Supplied	○	⊖	○	⊕



INTAKE AIR TEMPERATURE SENSOR CHECK

1. Disconnect the air flow sensor connectors.
2. Measure resistance between terminals 5 and 6.

Temperature [°C]	Resistance (kΩ)
0	5.3–6.7
20	2.3–3.0
80	0.30–0.42



3. Measure resistance while heating the sensor using a hair drier.

Temperature	Resistance
Higher	Smaller

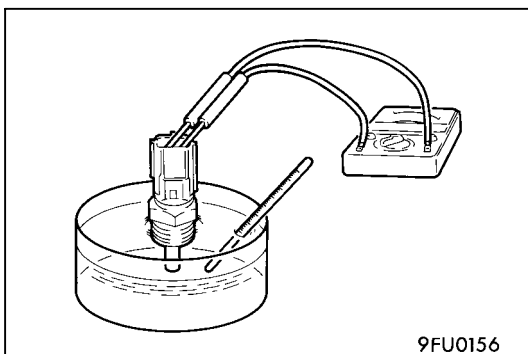
4. If resistance does not decrease as heat increases, replace the volume air flow sensor assembly.

ENGINE COOLANT TEMPERATURE SENSOR CHECK

Caution

Be careful not to touch the tool against the connector (resin section) when removing and installing.

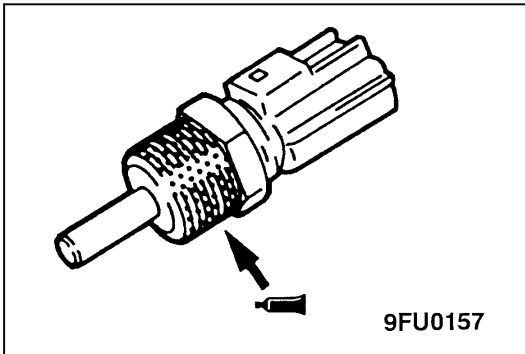
1. Remove engine coolant temperature sensor from the intake manifold.



2. With temperature sensing portion of engine coolant temperature sensor immersed in hot water, check resistance.

Temperature [°C]	Resistance (kΩ)
0	5.1–6.5
20	2.1–2.7
40	0.9–1.3
80	0.26–0.36

3. If the resistance deviates from the standard value greatly, replace the sensor.



4. Apply sealant threaded portion.

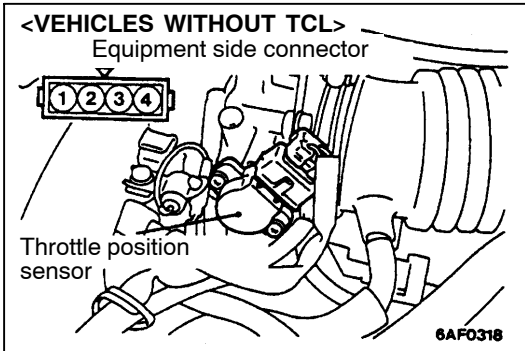
Specified sealant:

Loctite 577 or equivalent

5. Install engine coolant temperature sensor and tighten it to specified torque.

Sensor tightening torque: 30 Nm

6. Fasten harness connectors securely.

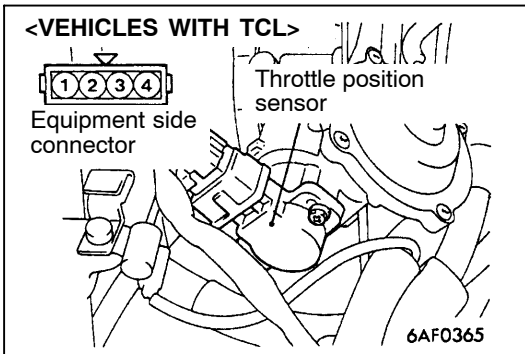


THROTTLE POSITION SENSOR CHECK

1. Disconnect the throttle position sensor connector.
2. Measure the resistance between the throttle position sensor side connector terminal 1 and terminal 4.

Standard value: 3.5–6.5 kΩ

3. Measure the resistance between the throttle position sensor side connector terminal 3 and terminal 4.



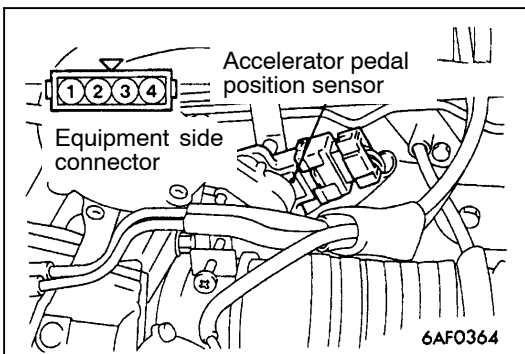
Normal Condition:

Throttle valve slowly open until fully open from the idle position

Changes smoothly in proportion to the opening angle of the throttle valve

4. If the resistance is outside the standard value, or if it doesn't change smoothly, replace the throttle position sensor.

NOTE: For the throttle position sensor adjustment procedure, refer to [<Vehicles without TCL>](#), [<Vehicles with TCL>](#).



ACCELERATOR PEDAL POSITION SENSOR CHECK (Vehicles with TCL)

1. Disconnect the accelerator pedal position sensor connector.
2. Measure the resistance between the accelerator pedal position sensor side connector terminal 1 and terminal 4.

Standard value: 3.5–6.5 kΩ

3. Measure the resistance between the accelerator pedal position sensor side connector terminal 1 and terminal 2.

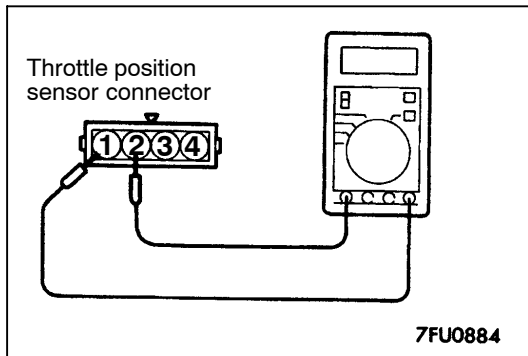
Normal Condition:

Throttle valve slowly open until fully open from the idle position

Changes smoothly in proportion to the opening angle of the throttle valve

4. If the resistance is outside the standard value, or if it doesn't change smoothly, replace the accelerator pedal position sensor.

NOTE: For the accelerator pedal position sensor adjustment procedure, refer [On Vehicle Service](#).



CLOSED THROTTLE POSITION SWITCH CHECK <Vehicles without TCL>

1. Disconnect the throttle position sensor connector.
2. Check the continuity between the throttle position sensor connector side terminal 1 and terminal 2.

Accelerator pedal	Continuity
Depressed	Non-conductive
Released	Conductive (0 Ω)

3. If out of specification, replace the throttle position sensor.

NOTE: After replacement, the closed throttle position switch and throttle position sensor should be adjusted.
(Refer [On Vehicle Service.](#))

CLOSED THROTTLE POSITION SWITCH CHECK (Vehicles with TCL)

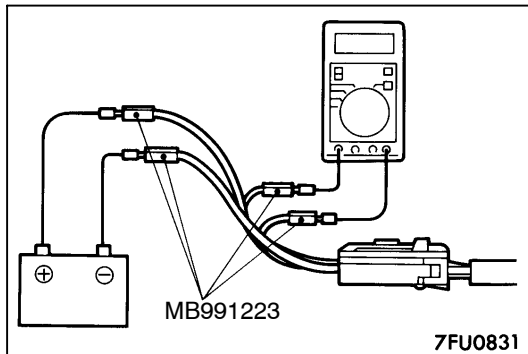
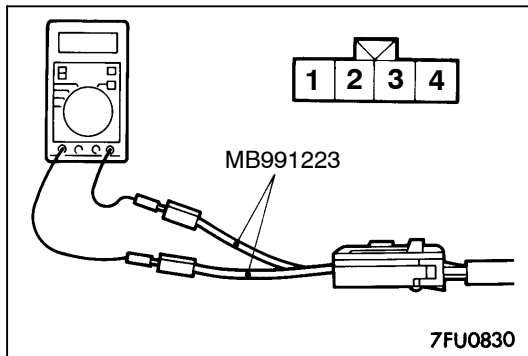
1. Disconnect the accelerator pedal position sensor connector.
2. Check the continuity between the accelerator pedal position sensor connector side terminal 3 and terminal 4.

Normal Condition:

Accelerator pedal	Continuity
Depressed	Non-conductive(∞ Ω)
Released	Conductive (0 Ω)

3. If out of specification, replace the accelerator pedal position sensor.

NOTE: After replacement, the closed throttle position switch and accelerator pedal position switch should be adjusted.
(Refer [On Vehicle Service.](#))



OXYGEN SENSOR CHECK

1. Disconnect the oxygen sensor connector and connect the special tool (test harness) to the connector on the oxygen sensor side.
2. Make sure that there is continuity [$7-40\ \Omega$ at 20°C] between terminal 3 and terminal 4 on the heated oxygen sensor connector.
3. If there is no continuity, replace the heated oxygen sensor.
4. Warm up the engine until engine coolant is 80°C or higher.
5. Use the jumper wires to connect terminal 3 of the heated oxygen sensor connector to the battery (+) terminal and terminal 4 to the battery (-) terminal.

Caution

Be very careful when connecting the jumper wires; incorrect connection can damage the heated oxygen sensor.

6. Connect a digital voltage meter between terminal 1 and terminal 2.
7. While repeatedly racing the engine, measure the heated oxygen sensor output voltage.

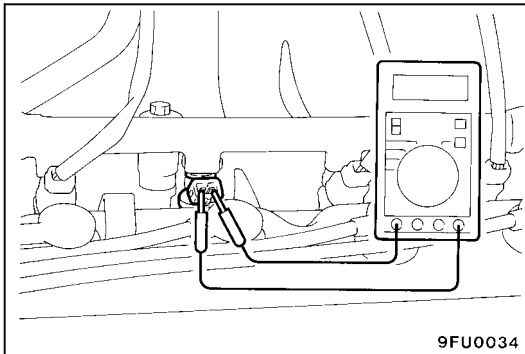
Standard value:

Engine	Heated oxygen sensor output voltage	Remarks
When racing engine	0.6–1.0V	If you make the air/fuel ratio rich by racing the engine repeatedly, a normal heated oxygen sensor will output a voltage of 0.6–1.0V.

8. If the sensor is defective, replace the heated oxygen sensor.

NOTE

For removal and installation of the heated oxygen sensor, refer [On Vehicle Service](#).



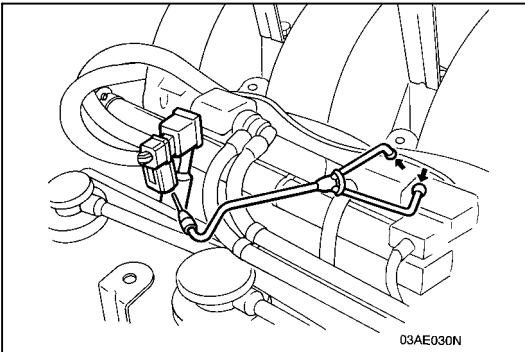
INJECTOR CHECK

Measurement of Resistance between Terminals

1. Remove the injector connector.
2. Measure the resistance between terminals.

Standard value: 13–16 Ω [at 20°C]

3. Install the injector connector



Checking operation sound

Using a stethoscope or long blade screwdriver, check the operation sound (“chi-chi-chi”) of injectors during idling or during cranking. Check that as the engine speed increases, the frequency of the operating sound also increases.

Caution

Note that even if the injector you are checking is not operating, you will hear the operating sound of the other injectors.

NOTE

If no operating sound is heard from the injector that is being checked, check the injector drive circuit. If there is nothing wrong with the circuit, a defective injector or Engine A/T-ECU is suspected.

IDLE SPEED CONTROL (ISC) SERVO (STEPPER MOTOR) CHECK

Use a stethoscope or long blade screwdriver to check if the sound of the idle air control motor operating can be heard immediately after the ignition switch is turned to “ON”.

NOTE

If the motor operation cannot be heard, check the motor drive circuit and the idle air control motor.

CHECKING COIL RESISTANCE AND OPERATION

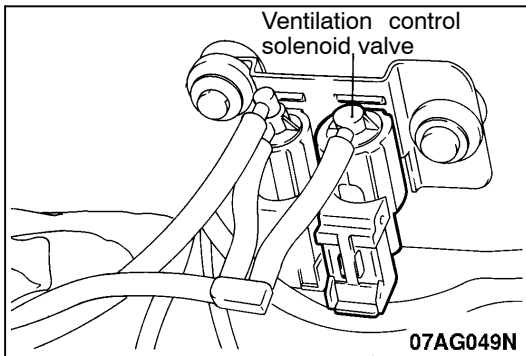
PURGE CONTROL SOLENOID VALVE CHECK

<Evaporative emission purge solenoid>

Refer [Emission Control System](#).

EGR CONTROL SOLENOID VALVE CHECK

Refer [Emission Control System](#).



VENTILATION CONTROL SOLENOID VALVE CHECK <Vehicles with TCL>

NOTE: When disconnecting the vacuum hose, always make a mark so that it can be reconnected at original position.

1. Disconnect the vacuum hose (green stripe) from the solenoid valve.
2. Disconnect the harness connector.

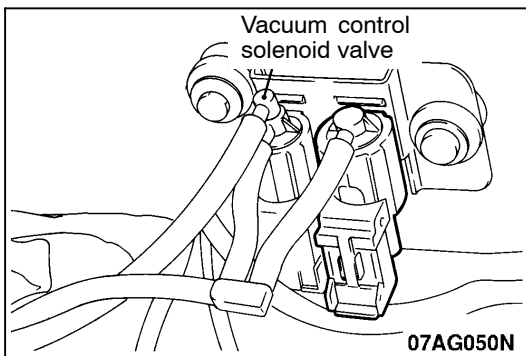
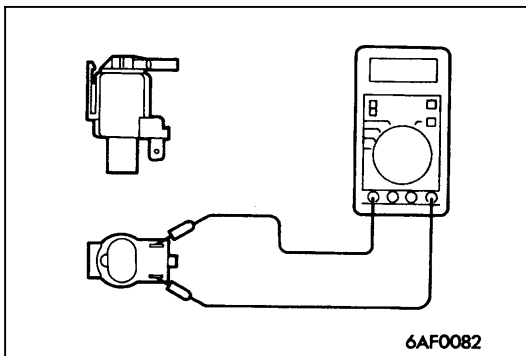
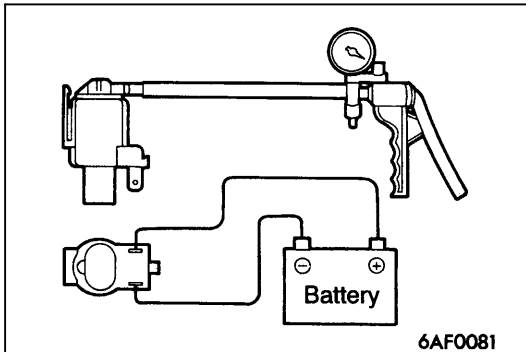
3. Connect a hand vacuum pump to the nipple.
4. Check air-tightness by applying a vacuum with voltage applied directly from the battery to the solenoid valve and without applying voltage.

Normal condition:

Battery voltage	Normal condition
Applied	Vacuum maintained
Not applied	Vacuum leaks

5. Measure the resistance between the terminals of the solenoid valve.

Standard value: 36–44 Ω [at 20°C]



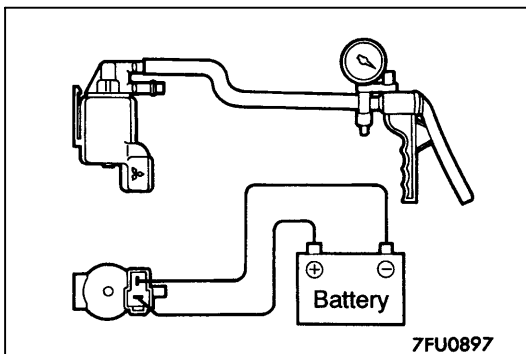
VACUUM CONTROL SOLENOID VALVE CHECK <Vehicles with TCL>

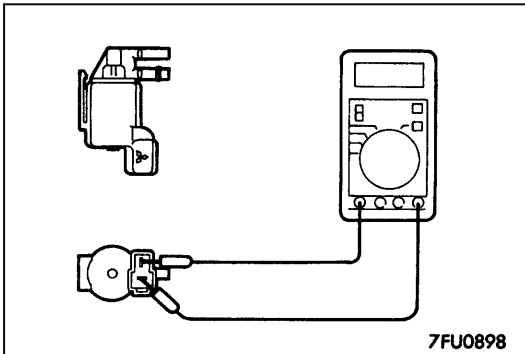
NOTE: When disconnecting the vacuum hose, always make a mark so that it can be reconnected at original position.

1. Disconnect the vacuum hose (blue stripe, green stripe) from the solenoid valve.
2. Disconnect the harness connector.

3. Connect a hand vacuum pump to the nipple to which the blue-striped vacuum hose was connected.
4. Check air-tightness by applying a vacuum with voltage applied directly from the battery to the solenoid valve and without applying voltage.

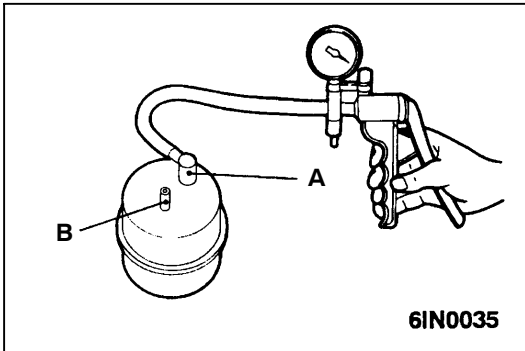
Battery voltage	Normal condition
Applied	Vacuum leaks
Not applied	Vacuum maintained





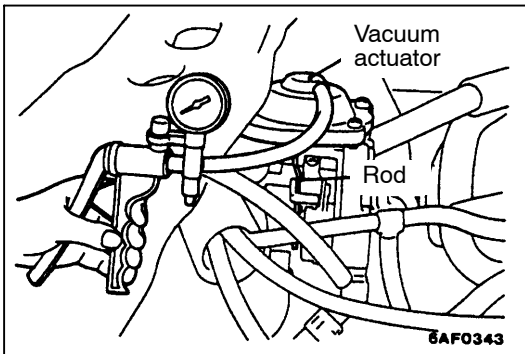
5. Measure the resistance between the terminals of the solenoid valve.

Standard value: 36–44 Ω [at 20°C]



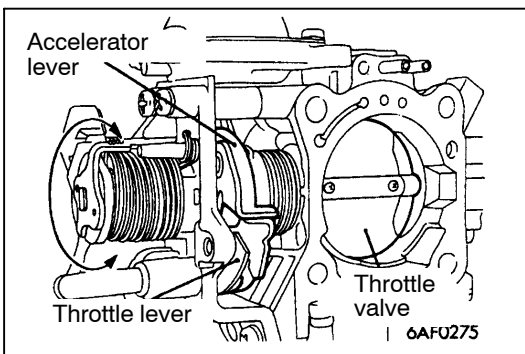
VACUUM TANK CHECK <Vehicles with TCL>

1. Connect a hand vacuum pump to vacuum tank A nipple, apply 67 kPa of vacuum and check that the vacuum is held.
2. Connect a hand vacuum pump to vacuum tank B nipple.
3. First, close A nipple with your finger and apply 67 kPa of vacuum. Then, check that vacuum leaks immediately when you remove the finger blocking the nipple.



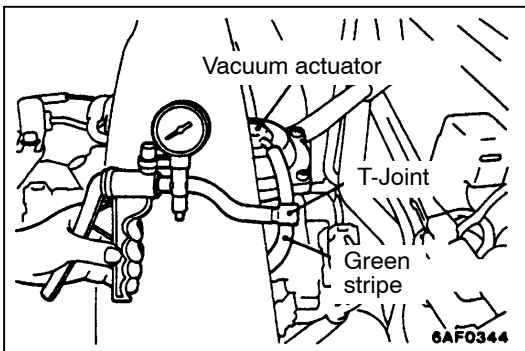
VACUUM ACTUATOR CHECK <Vehicles with TCL>

1. Remove the vacuum hose (green stripe) from the vacuum actuator and connect a hand vacuum pump to the vacuum actuator.
2. With the accelerator pedal depressed, check that the rod is pulled up and that vacuum is held when 27 kPa of vacuum is applied.



THROTTLE VALVE OPERATION CHECK <Vehicles with TCL>

1. Check that the throttle valve opens and closes smoothly (throttle lever moves) according to the opening and closing of the accelerator lever.
2. If the throttle valve does not open and close smoothly, there might be a deposit on the throttle valve, so clean the throttle body. (Refer [On Vehicle Service](#).)



NEGATIVE PRESSURE CHECK DURING TRACTION CONTROL OPERATION <Vehicles with TCL>

1. Disconnect the vacuum hose (green stripe) from the vacuum actuator, connect a hand vacuum pump between the actuator nipple and the vacuum hose via a T-joint. Set the hand vacuum pump near the driver's seat so that the negative pressure check can be carried out at the driver's seat.

2. Check the negative pressure during traction control operation.

Inspection service points are the same as for the traction control operation inspection.

(Refer [On Vehicle Service Group 13H.](#))

Normal condition:

Vehicle condition	Normal negative pressure when accelerator pedal is depressed
Vehicle is lifted up	20 kPa or more
Driving on a dry, sealed road surface	No change

NOTE: The traction control system function will stop 20 seconds after the accelerator pedal has been depressed, and negative pressure will gradually drop.

INJECTOR

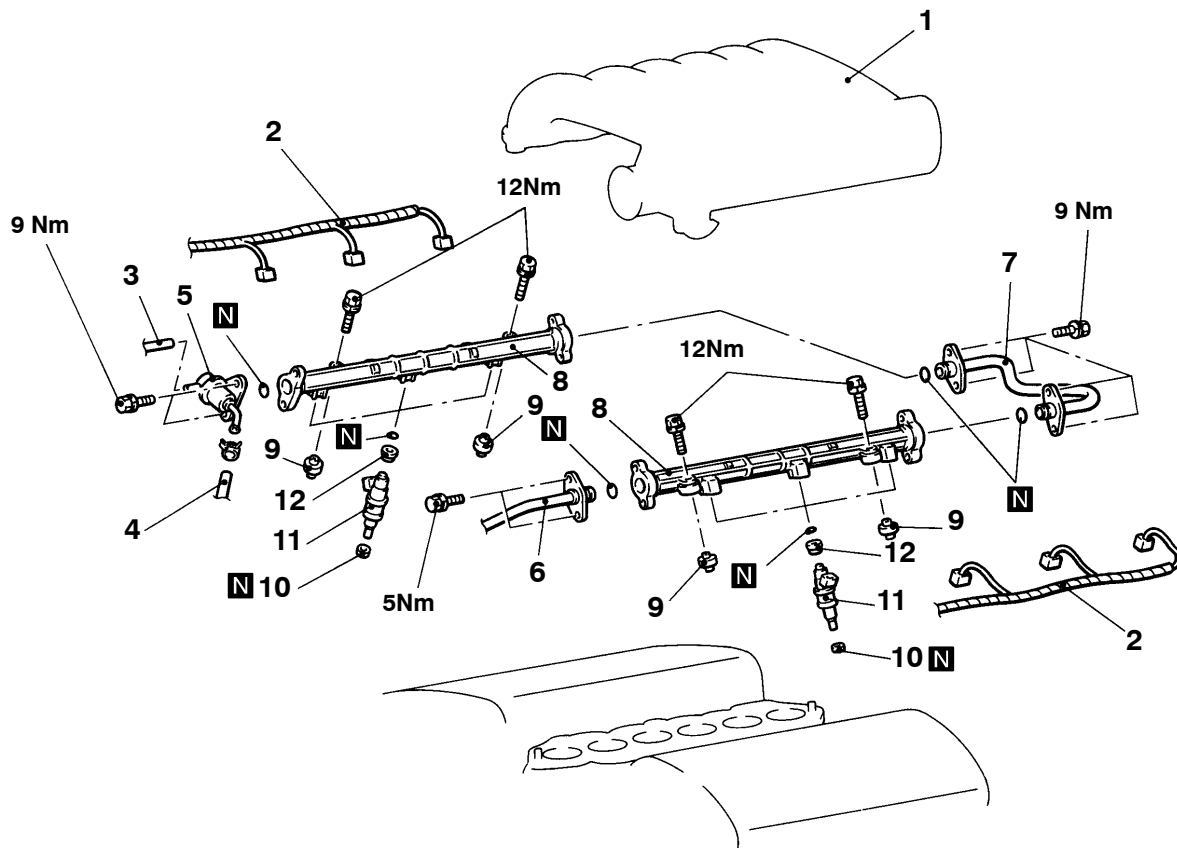
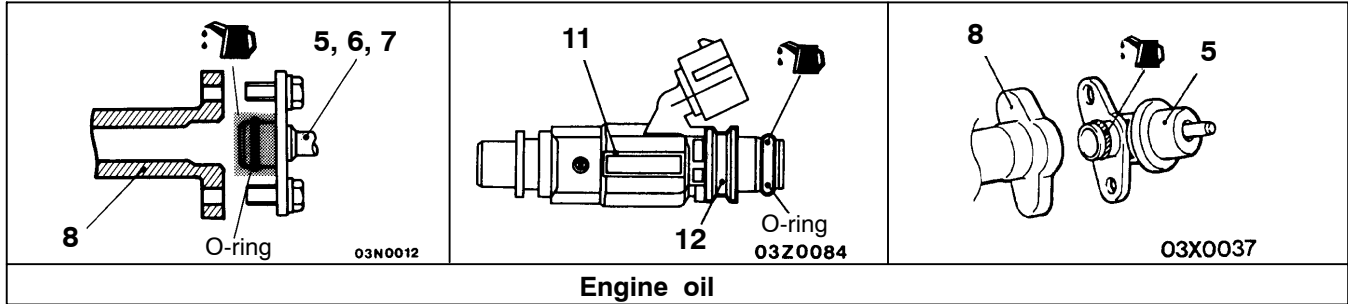
REMOVAL AND INSTALLATION

Pre-removal Operation

- (1) Fuel Discharge Prevention (Refer [On Vehicle Service.](#))

Post-installation Operation

- (1) Accelerator Cable Adjustment (Refer [On Vehicle Service.](#))
- (2) Fuel Leakage Inspection



03AE038N

Removal steps

1. Surge tank (Refer [Group15.](#))
2. Injector connectors
3. Vacuum hose connection
4. Fuel return hose connection
5. Fuel pressure regulator
6. High-pressure fuel hose connection



7. Fuel pipe
8. Fuel rail
9. Insulators
10. Insulators
11. Injectors
12. Grommet

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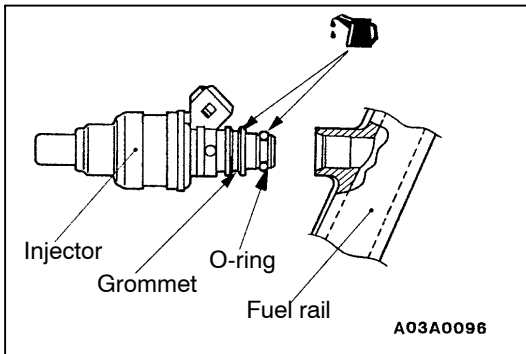
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REMOVAL SERVICE POINT**◀A▶ FUEL RAIL/INJECTOR REMOVAL**

Remove the fuel rail (with the injectors attached to it.)

Caution

Care must be taken, when removing the fuel rail, not to drop the injector.

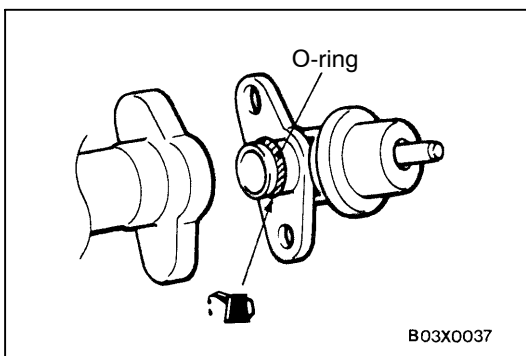
**INSTALLATION SERVICE POINTS****▶A◀ INJECTOR INSTALLATION**

1. Apply a drop of new engine oil to the O-ring.

Caution

Be sure not to let engine oil in the fuel rail.

2. While turning the injector to the left and right, install it to the fuel rail.
3. Check to be sure that the injector turns smoothly. If it does not turn smoothly, the O-ring may be trapped, remove the injector and then re-insert it into the fuel rail and check once again.

**▶B◀ FUEL PRESSURE REGULATOR INSTALLATION**

1. When connecting the fuel-pressure regulator to the fuel rail, apply a drop of new engine oil to the O-ring, and then insert, being careful not to damage the O-ring.

Caution

Be sure not to let engine oil in the fuel rail.

2. Check to be sure that the fuel pressure regulator turns smoothly. If it does not turn smoothly, the O-ring may be trapped, remove the fuel pressure regulator and then re-insert it into the fuel rail and check once again.
3. Tighten the bolts to the specified torque.

Specified tightening torque : 9 Nm

- Specified tightening torque : 5Nm**

THROTTLE BODY

REMOVAL AND INSTALLATION

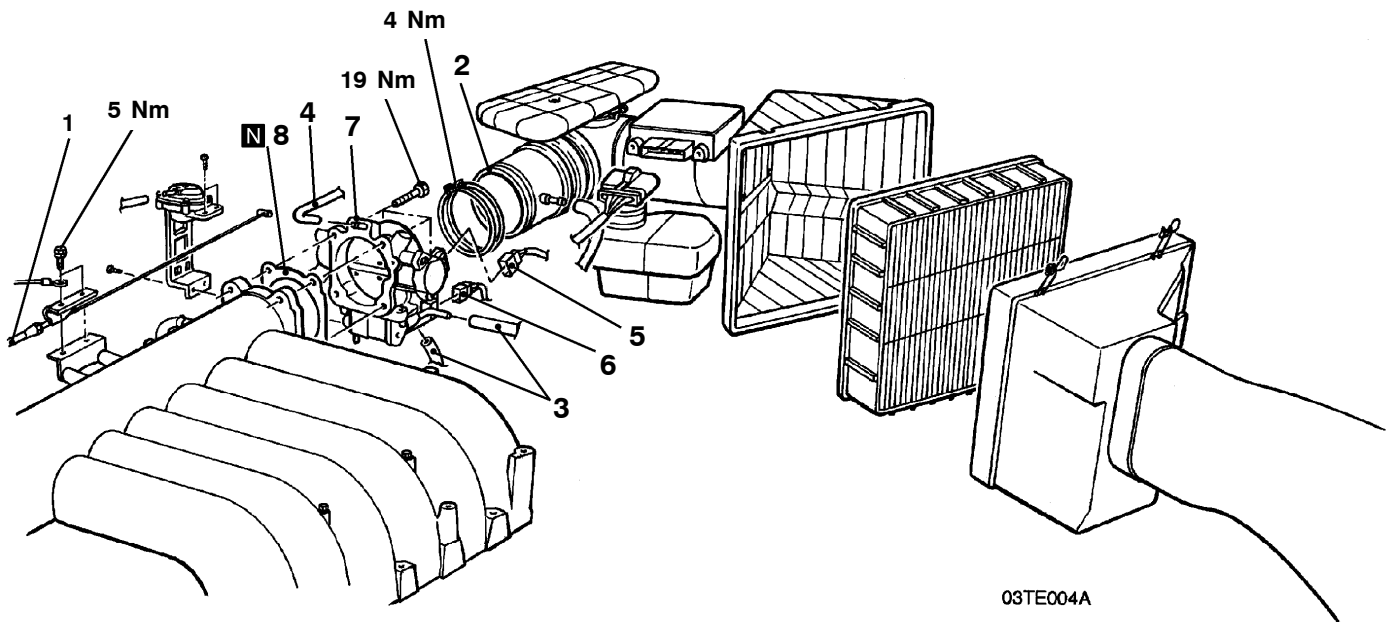
<Vehicles without traction control, with cruise control>

Pre-removal Operation

- Coolant Draining
(Refer [Engine Coolant Replacement.](#))

Post-installation Operation

- (1) Coolant Supplying
(Refer [Engine Coolant Replacement.](#))
- (2) Accelerator Cable Adjustment
(Refer [On Vehicle Service.](#))



Removal steps

1. Accelerator cable connection
2. Air intake hose
3. Heater hose connection
4. Vacuum hose connection

5. Throttle position sensor connector
6. Idle speed control servo connector
7. Throttle body
8. Gasket



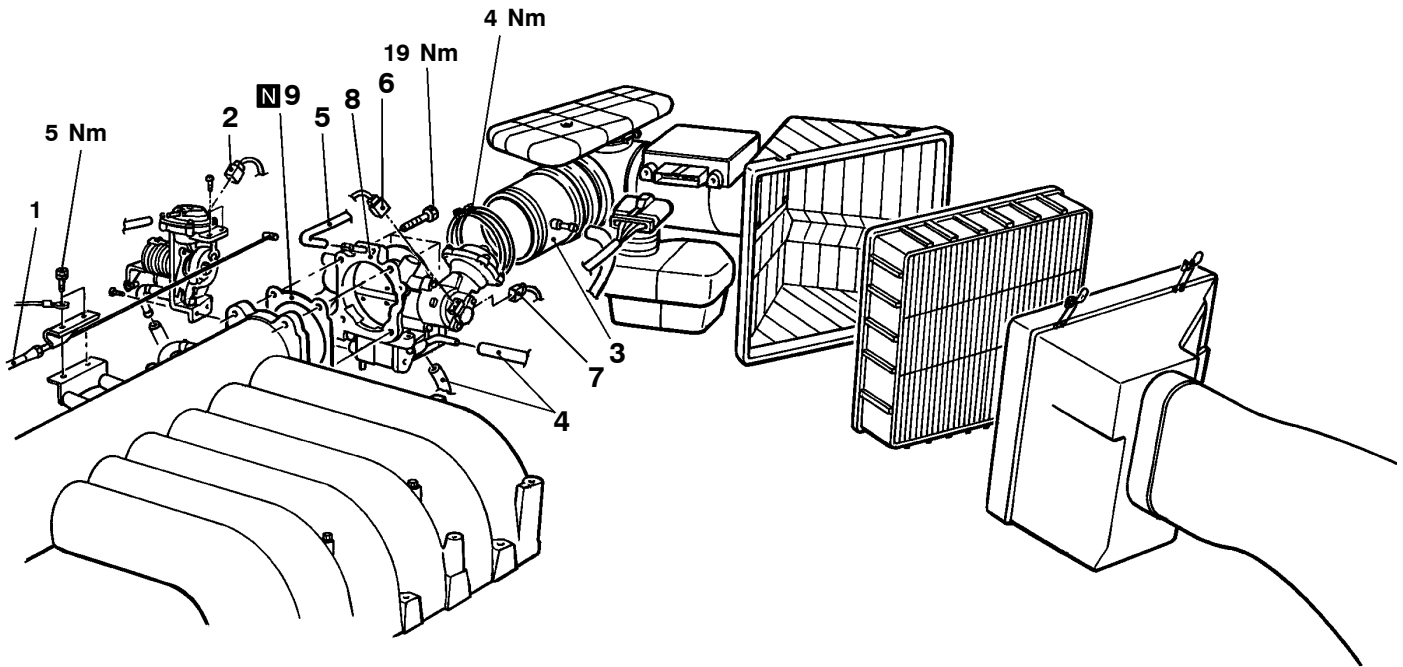
<Vehicles with traction control and cruise control>

Pre-removal Operation

- Coolant Draining
(Refer [Engine Coolant Replacement.](#))

Post-installation Operation

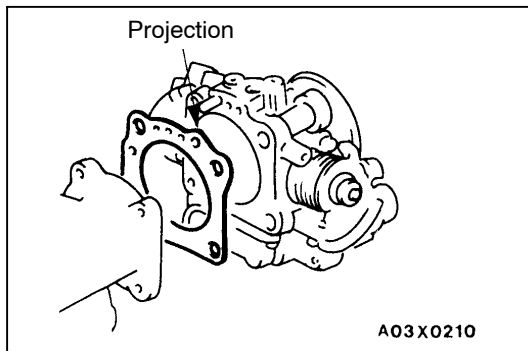
- (1) Coolant Supplying
(Refer [Engine Coolant Replacement.](#))
- (2) Accelerator Cable Adjustment
(Refer [On Vehicle Service.](#))



03TH087A

REMOVAL STEPS

1. Accelerator cable connection
2. Accelerator pedal position sensor connector
3. Air intake hose
4. Heater hose connection
5. Vacuum hose connection
6. Throttle position sensor connector
7. Idle speed control motor connector
8. Throttle body
9. Gasket



INSTALLATION SERVICE POINT

►A◄ GASKET INSTALLATION

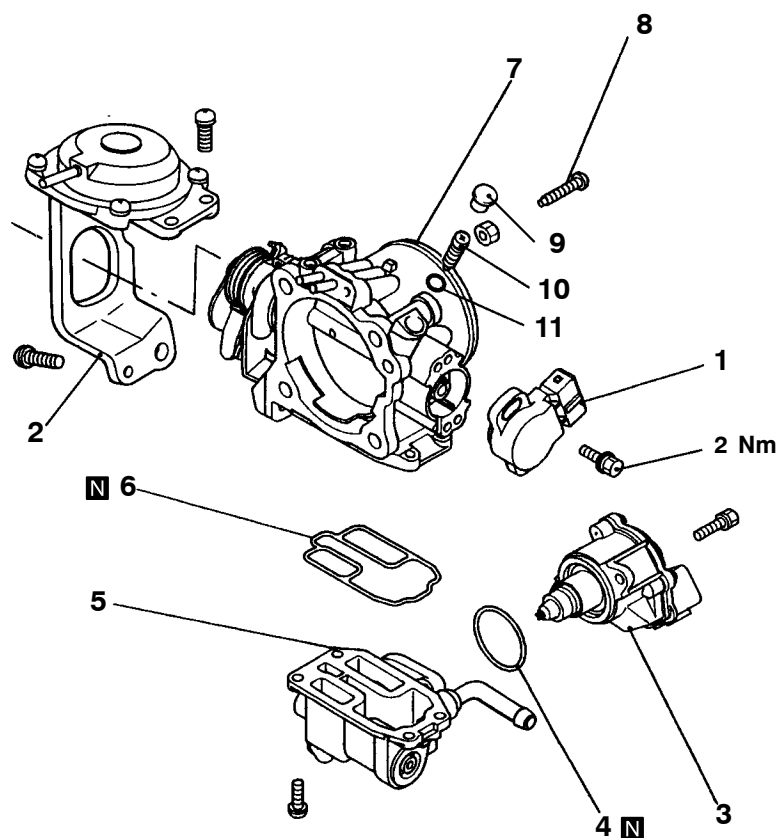
Install the gasket so that the projection is where shown in the illustration.

Caution

Poor idling etc. may result if the gasket is installed incorrectly.

DISASSEMBLY AND REASSEMBLY

<Vehicles without traction control, with cruise control>

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03TH088A

DISASSEMBLY STEPS

1. Throttle position sensor
2. Lever assembly
3. Idle air control motor
4. O-ring
5. Idle speed control body servo
6. Gasket
7. Throttle body
8. Fixed SAS
9. Cap

10. Speed adjusting screw
11. O-ring

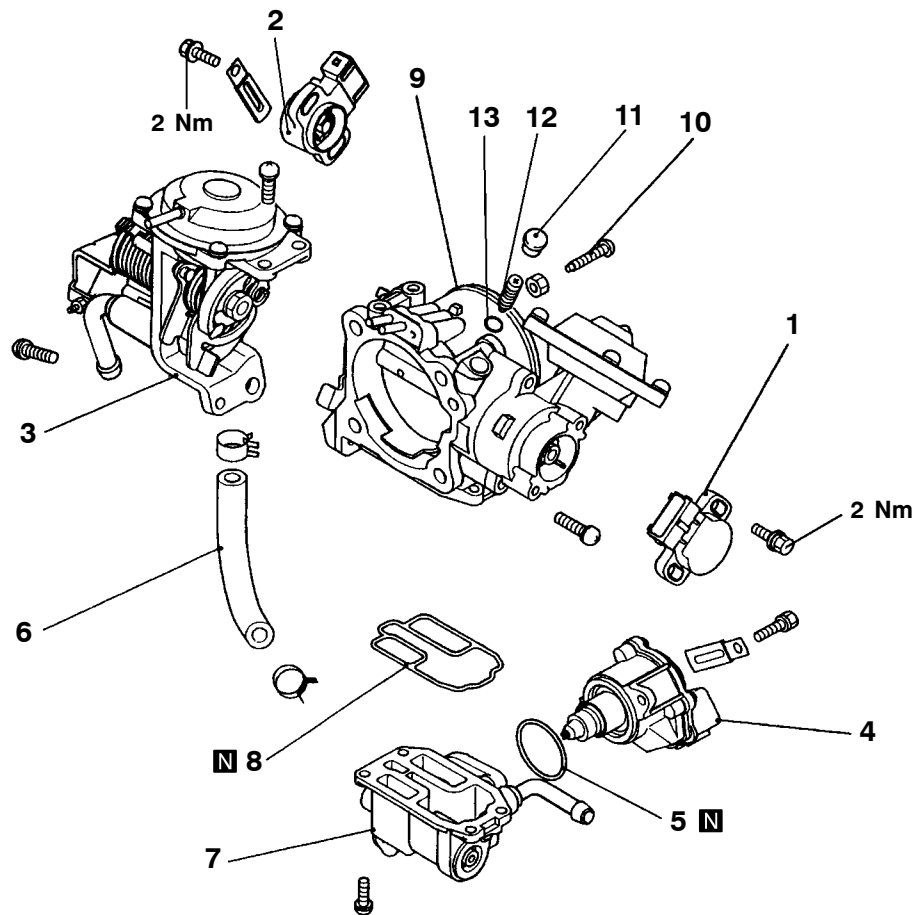
NOTE

1. The fixed SAS is correctly adjusted at the factory and should not be removed.
2. If the fixed SAS should happen to have been removed, carry out fixed SAS adjustment. (Refer [On Vehicle Service.](#))

<Vehicles with traction control, and cruise control>

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03TH089A

DISASSEMBLY STEPS


1. Throttle position sensor
2. Accelerator pedal position sensor
3. Lever assembly
4. Idle air control motor
5. O-ring
6. Water hose
7. Idle speed control body assembly
8. Gasket
9. Throttle body
10. Fixed SAS

11. Cap
12. Speed adjusting screw
13. O-ring

NOTE

1. The fixed SAS is correctly adjusted at the factory and should not be removed.
2. If the fixed SAS should happen to have been removed, carry out fixed SAS adjustment. (Refer [On Vehicle Service](#).)

CLEANING THROTTLE BODY PARTS

- Clean all throttle body parts.
Do not use solvents to clean the following parts:
 - Throttle position sensor
 - Accelerator pedal position sensor
 - Idle speed control body assembly
If these parts are immersed in solvent, their insulation will deteriorate.
Wipe them with a cloth only.
- Check if the vacuum port or passage is clogged. Use compressed air to clean the vacuum passage.

REASSEMBLY SERVICE POINT

►A◀ ACCELERATOR PEDAL POSITION SENSOR(APS) INSTALLATION

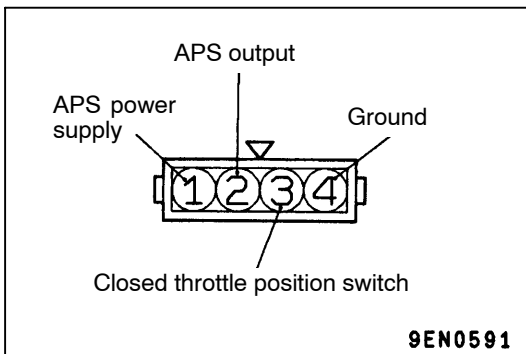
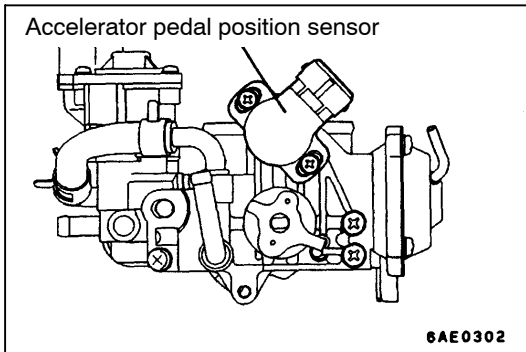
- Install the APS so that it faces as shown in the illustration, and then tighten it with the screw.
- Connect a multimeter between terminal 1 (APS power supply) and terminal 2 (APS output) of the APS connector, and check that the resistance increases gradually as the throttle valve is opened slowly to the fully open position.
- Check the continuity between terminal 3 (closed throttle position switch) and terminal 4 (ground) of the APS connector when the throttle valve is fully closed and fully open.

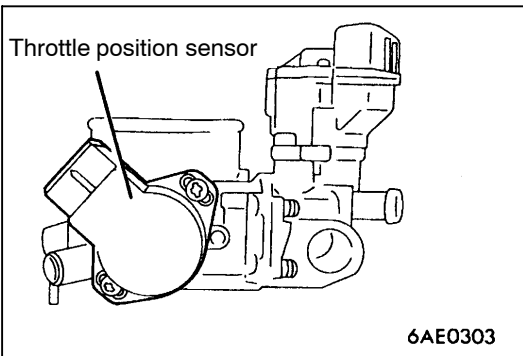
Normal condition:

Throttle valve condition	Continuity
Fully closed	Continuity
Fully open	No continuity

If there is no continuity when the throttle valve is fully closed, turn the APS body anti-clockwise and then check again.

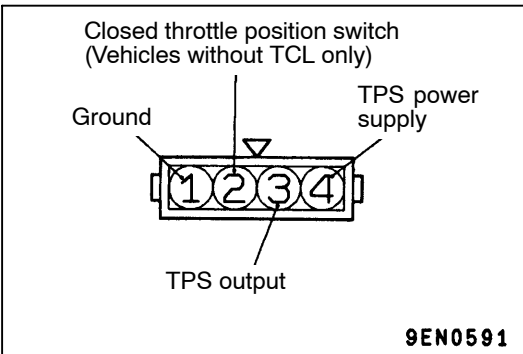
- If there is an abnormality, replace the APS.





►B◄ THROTTLE POSITION SENSOR (TPS) INSTALLATION

1. Install the TPS so that it faces as shown in the illustration, and then tighten it with the screw.
2. Connect a multimeter between terminal 4 (TPS power supply) and terminal 3 (TPS output) of the TPS connector, and check that the resistance increases gradually as the throttle valve is opened slowly to the fully open position.



3. For vehicles without TCL, check the continuity between terminal 2 (closed throttle position switch) and terminal 1 (ground) of the TPS connector when the throttle valve is fully closed and fully open.

Normal condition:

Throttle valve condition	Continuity
Fully closed	Continuity
Fully open	No continuity

If there is no continuity when the throttle valve is fully closed, turn the TPS body anti-clockwise and then check again.

4. If there is an abnormality, replace the TPS.

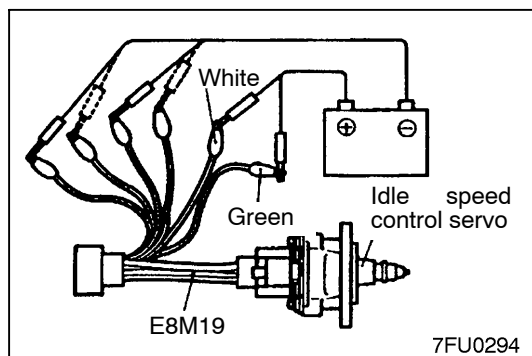
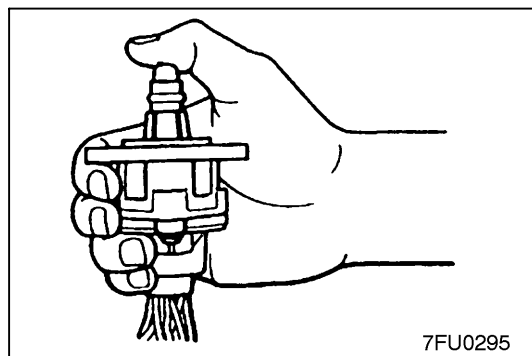
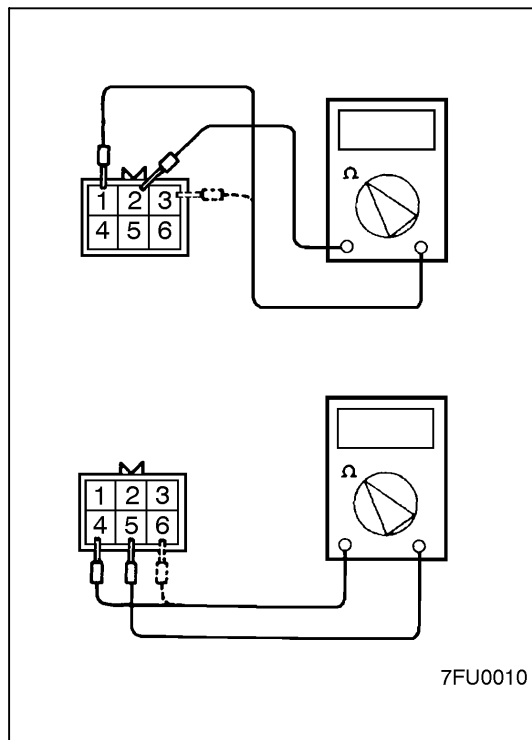
IDLE SPEED CONTROL (ISC) SERVO (STEPPER MOTOR) CHECKING THE COIL RESISTANCE

1. Disconnect the idle speed control motor connector and connect the Special Tool (test harness).
2. Measure the resistance between terminal 2 (white clip of the special tool) and either terminal 1 (red clip) or terminal 3 (blue clip) of the connector at the idle speed control servo side.

Standard value: 28 - 33 Ω @ 20°C

3. Measure the resistance between terminal 5 (green clip of the special tool) and either terminal 6 (yellow clip) or terminal 4 (black clip) of the connector at the idle speed control servo side.

Standard value: 28 - 33 Ω @ 20°C



OPERATIONAL CHECK

1. Remove the throttle body.
2. Remove the stepper motor.
3. Connect the special tool (test harness) to the idle speed control servo connector.
4. Connect the positive (+) terminal of a power supply (approx. 6 volts) to the white clip and the green clip.
5. With the idle speed control servo as shown in the illustration, connect the negative (-) terminal of the power supply to each clip as described in the following steps, and check whether or not a vibrating feeling (a feeling of very slight vibration of the stepper motor) is generated as a result of the activation of the stepper motor.
 1. Connect the negative (-) terminal of the power supply to the red and black clips.
 2. Connect the negative (-) terminal of the power supply to the blue and black clips.
 3. Connect the negative (-) terminal of the power supply to the blue and yellow clips.
 4. Connect the negative (-) terminal of the power supply to the red and yellow clips.
 5. Connect the negative (-) terminal of the power supply to the red and black clips.
 6. Repeat the tests in sequence from steps 5 to 1.
6. If, as a result of these tests, vibration is detected, the stepper motor can be considered normal.